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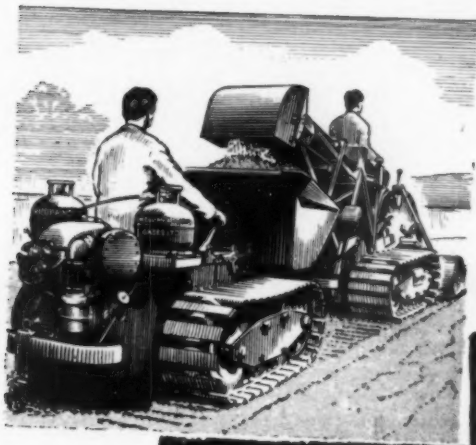
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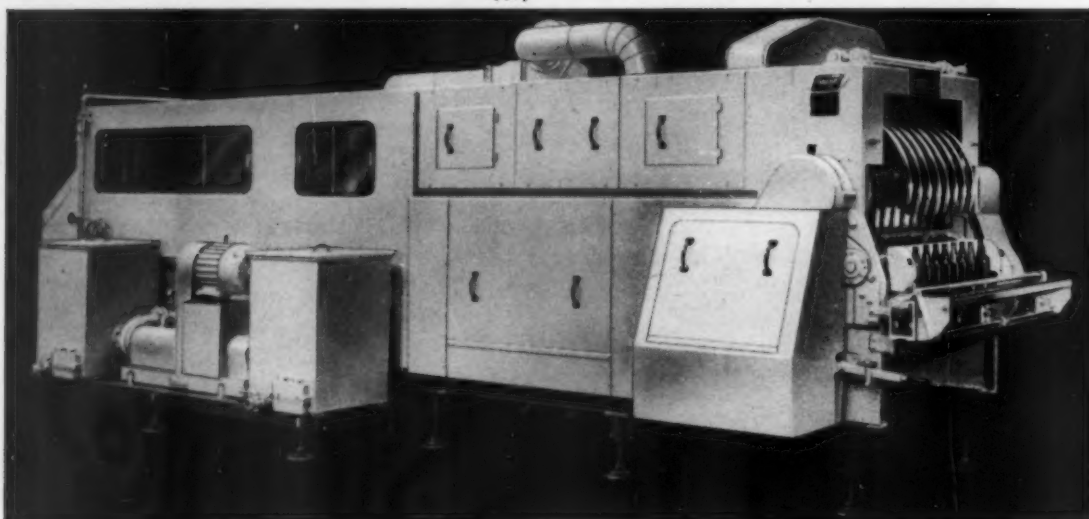
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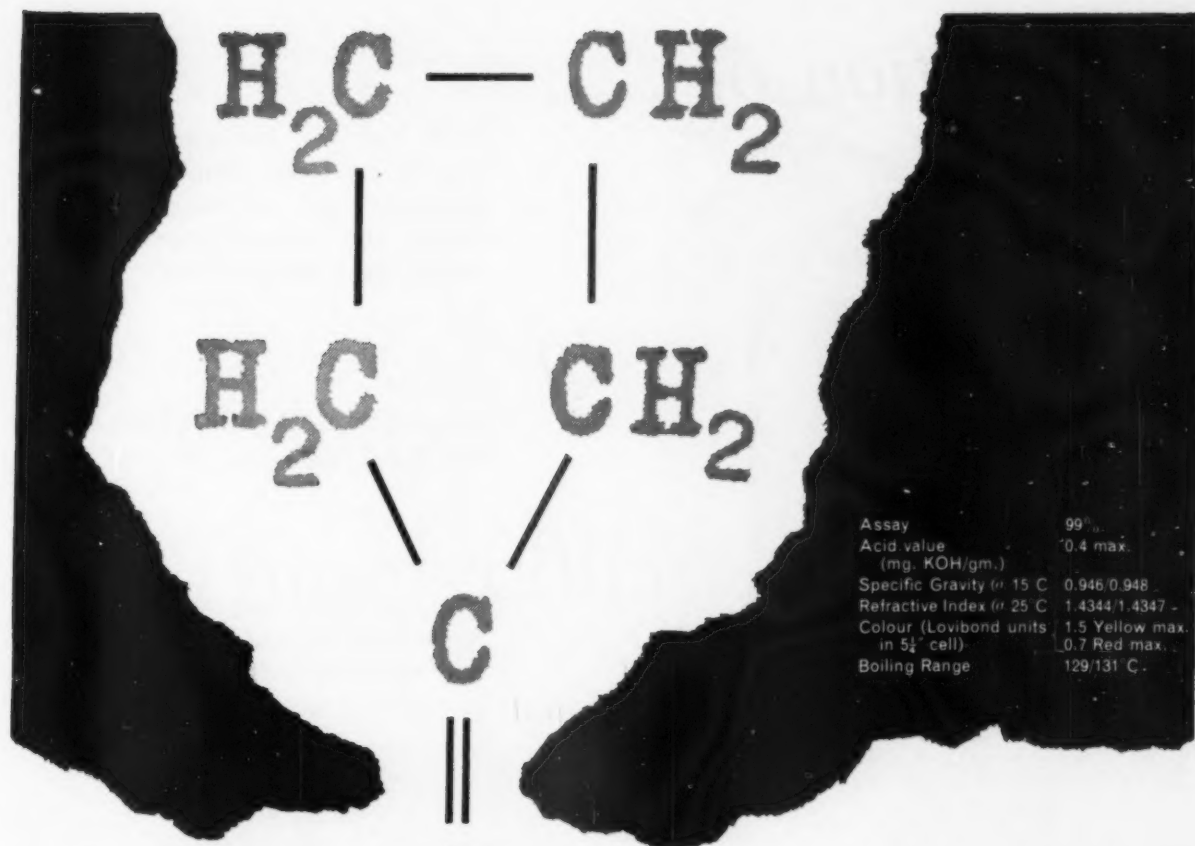
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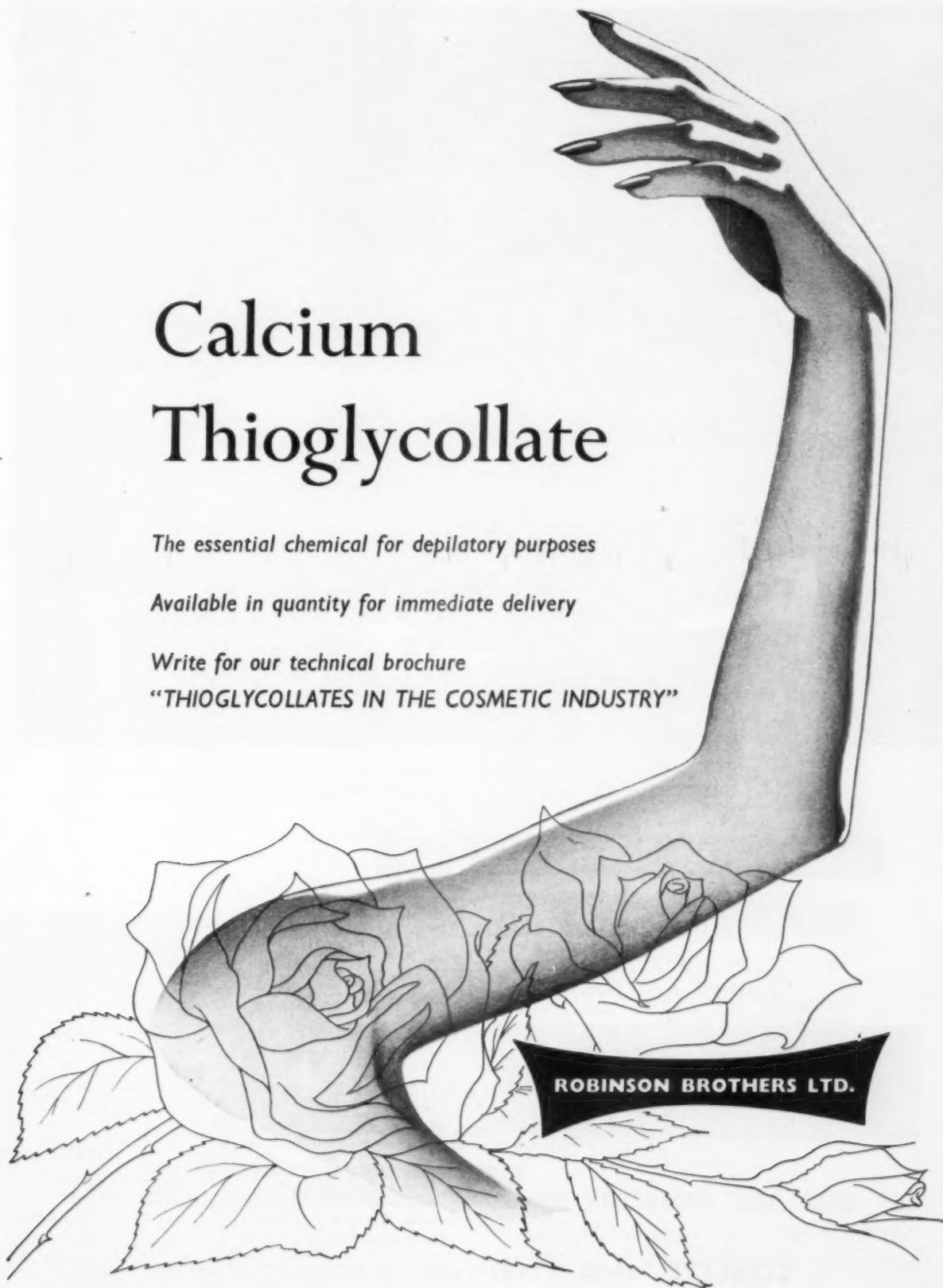
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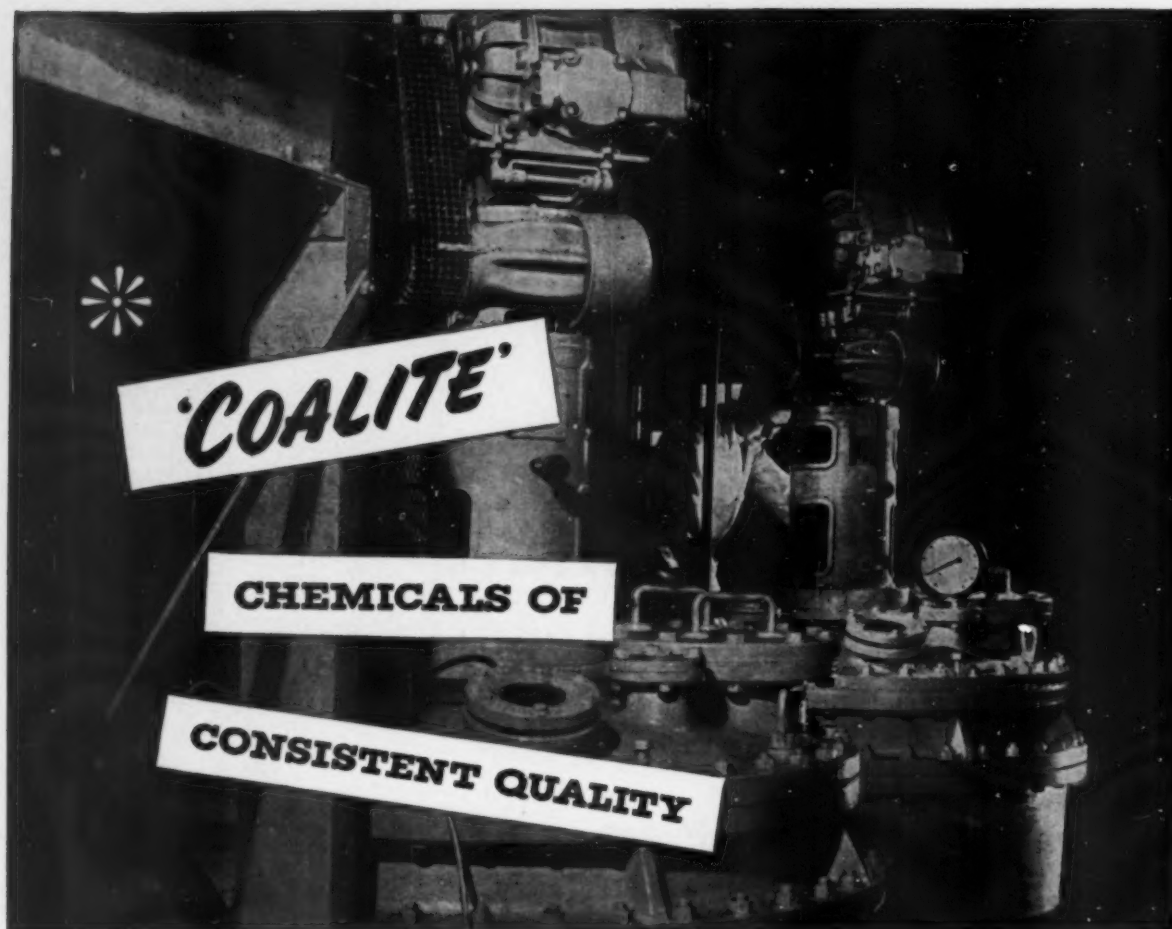
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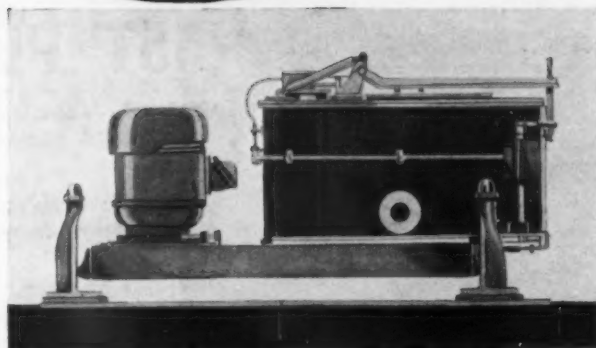
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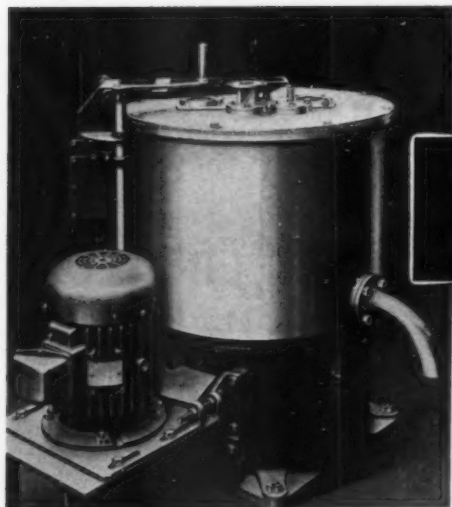


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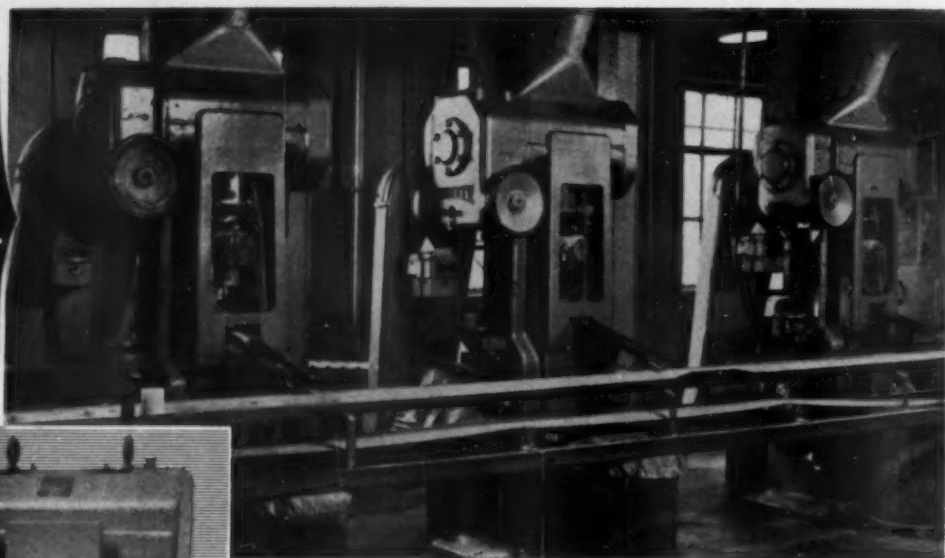
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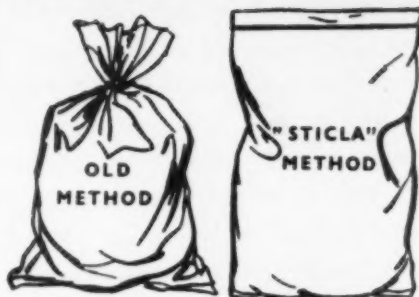
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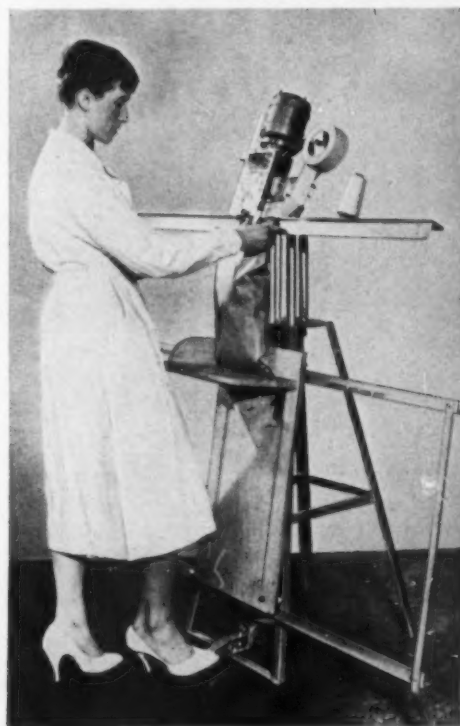
- (1) Saves container material, reducing costs, eliminating bunching.
- (2) Seals *any* weight and size polythene film bags or paper bags to a maximum length of 40" when filled.
- (3) "Sticla" produces a *hermetically sealed* container, stronger than the surrounding material.
- (4) Rip cord goes through seal, pull one end, bag opens,
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The Bag on the right of the illustration was sealed by the unique "STICLA" versatile high-speed adhesive bag-sealer

← the "STICLA" adhesive method for profit-happy packaging.

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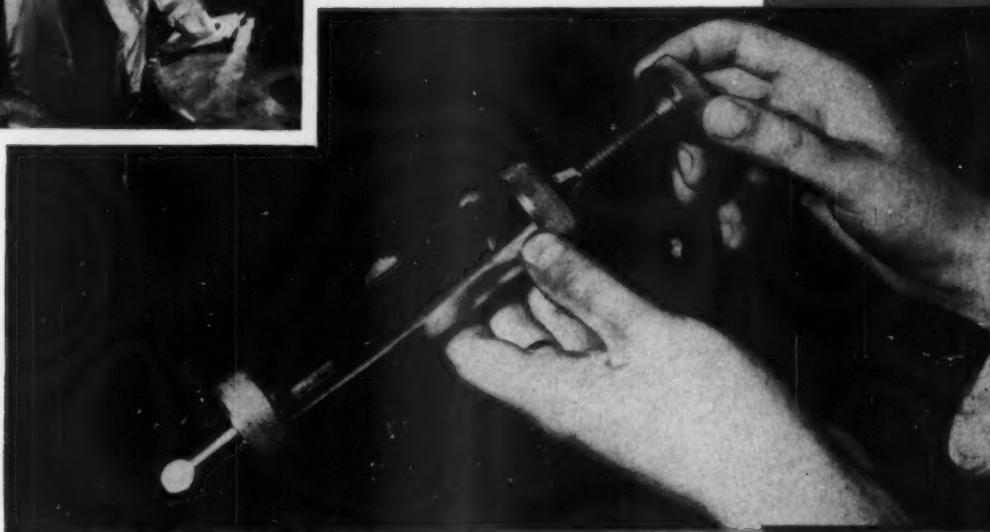
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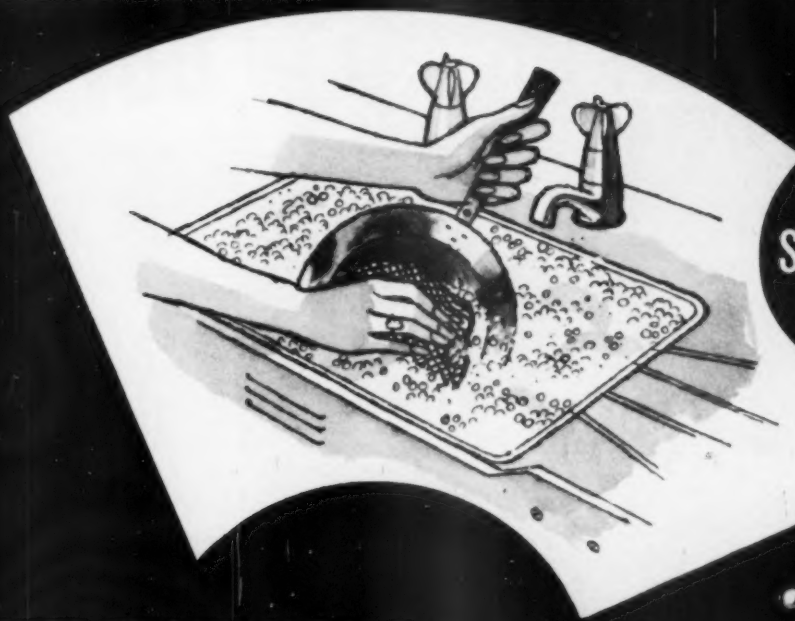
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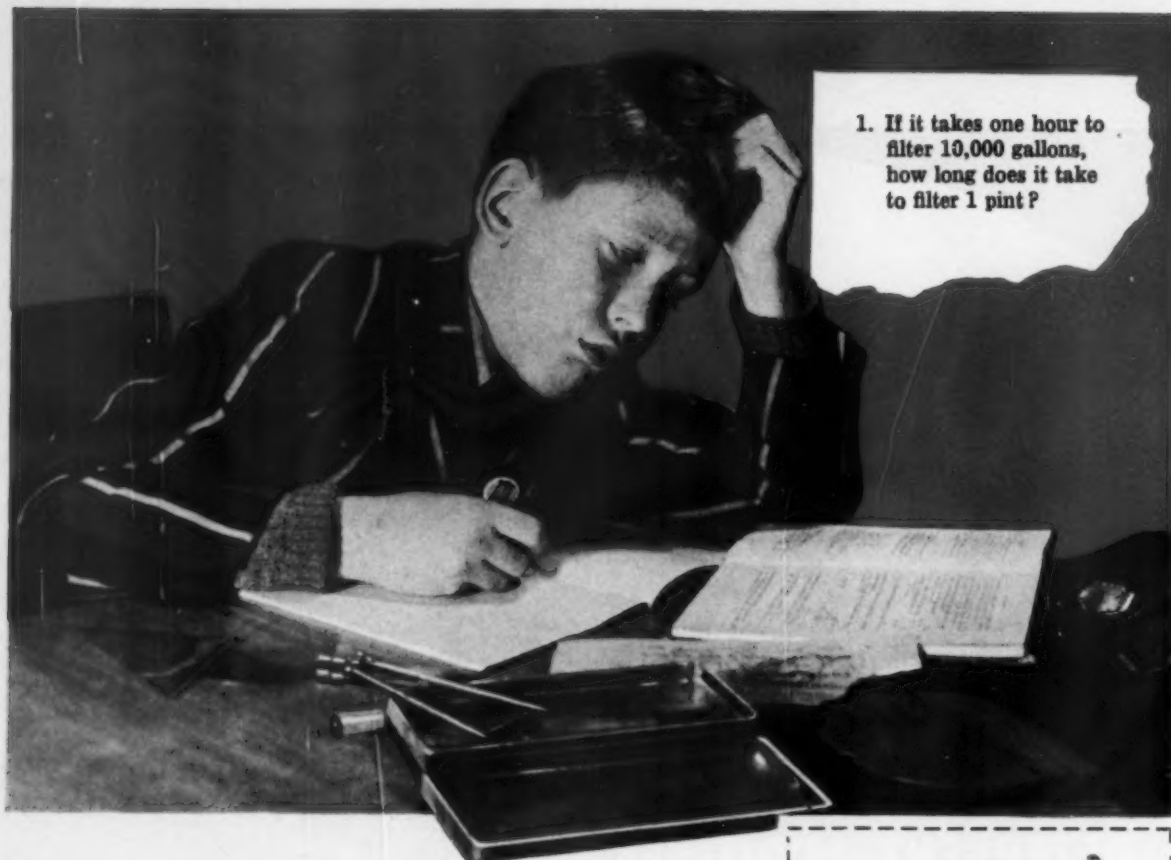
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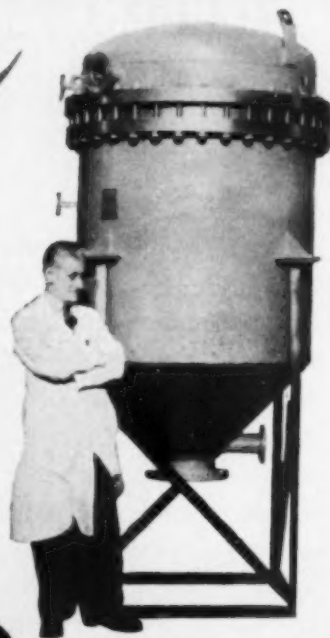
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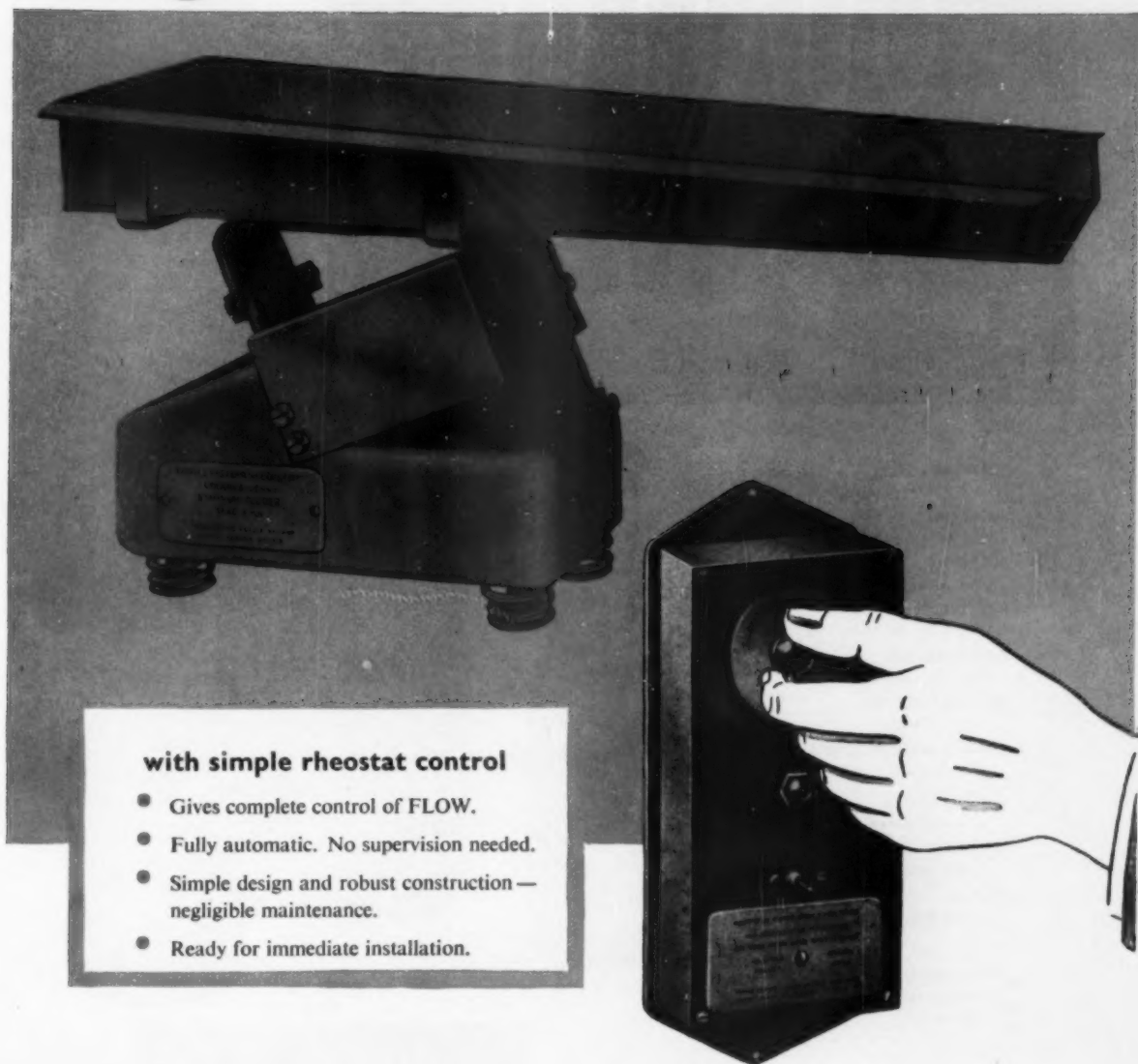
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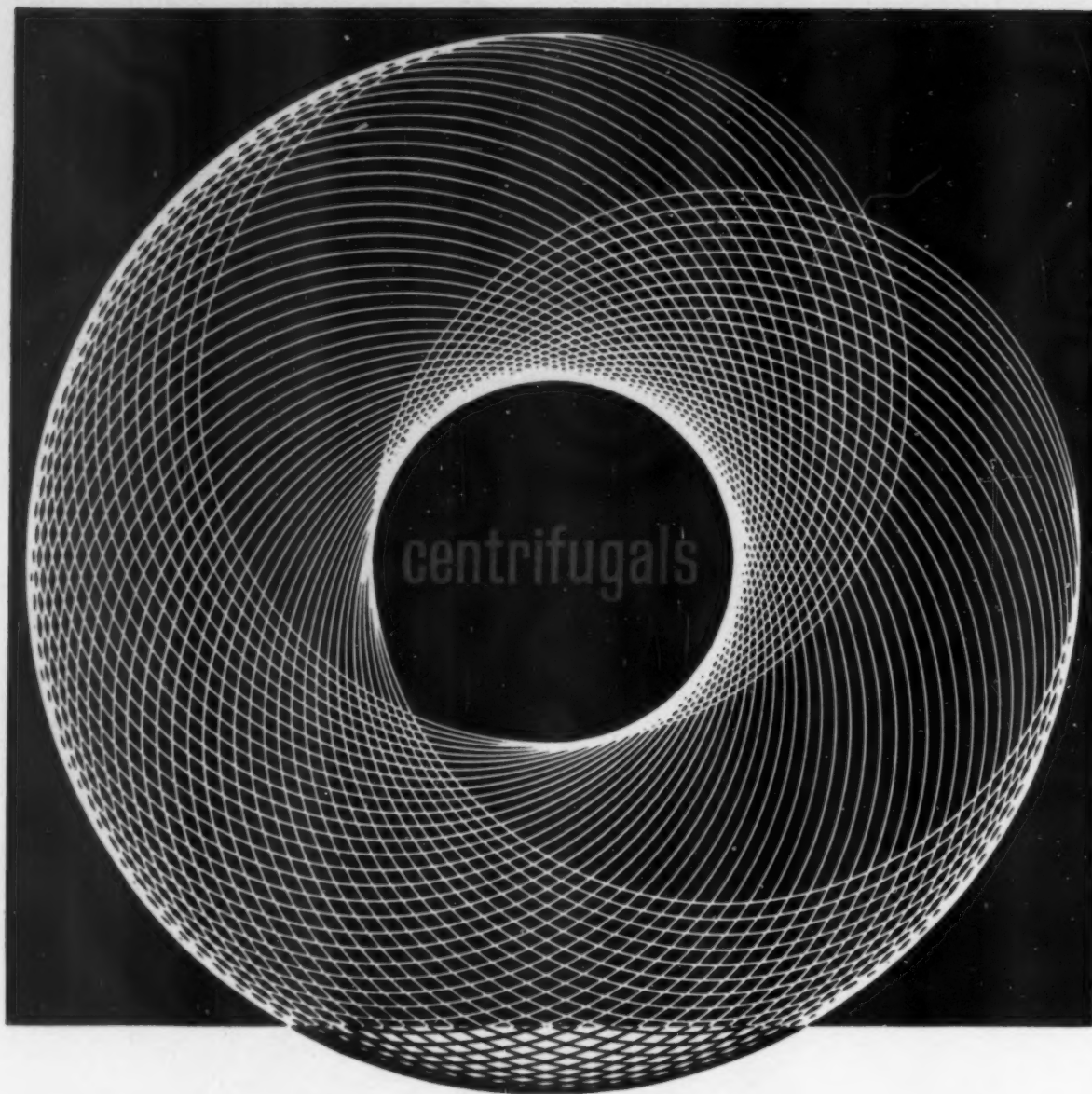
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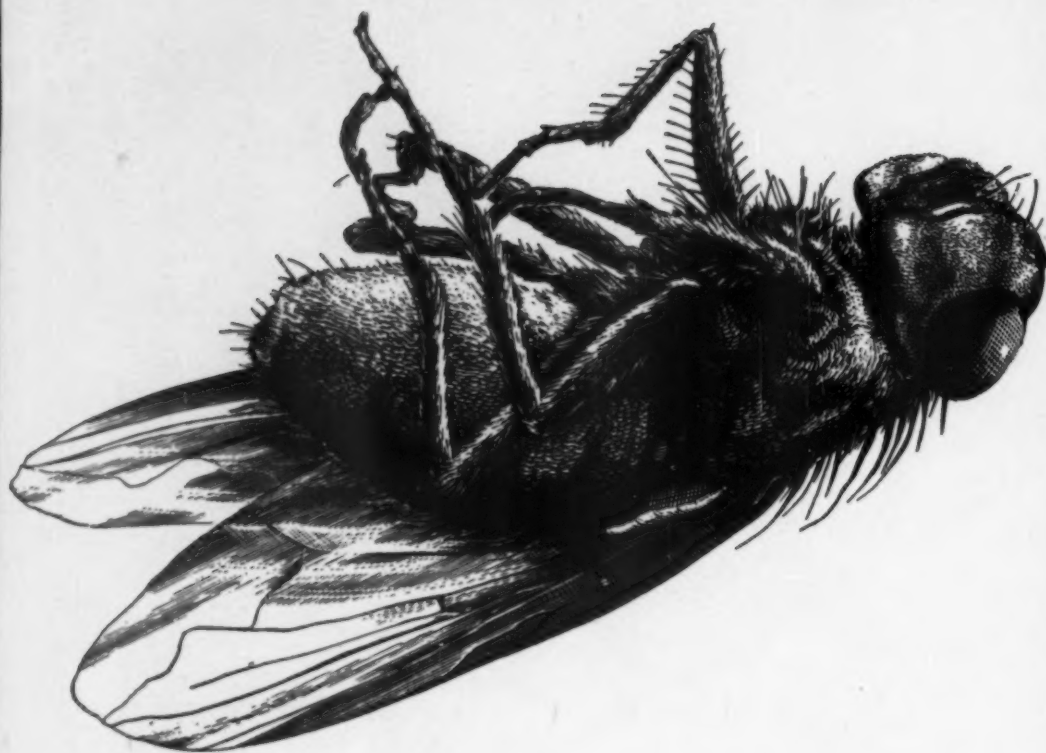
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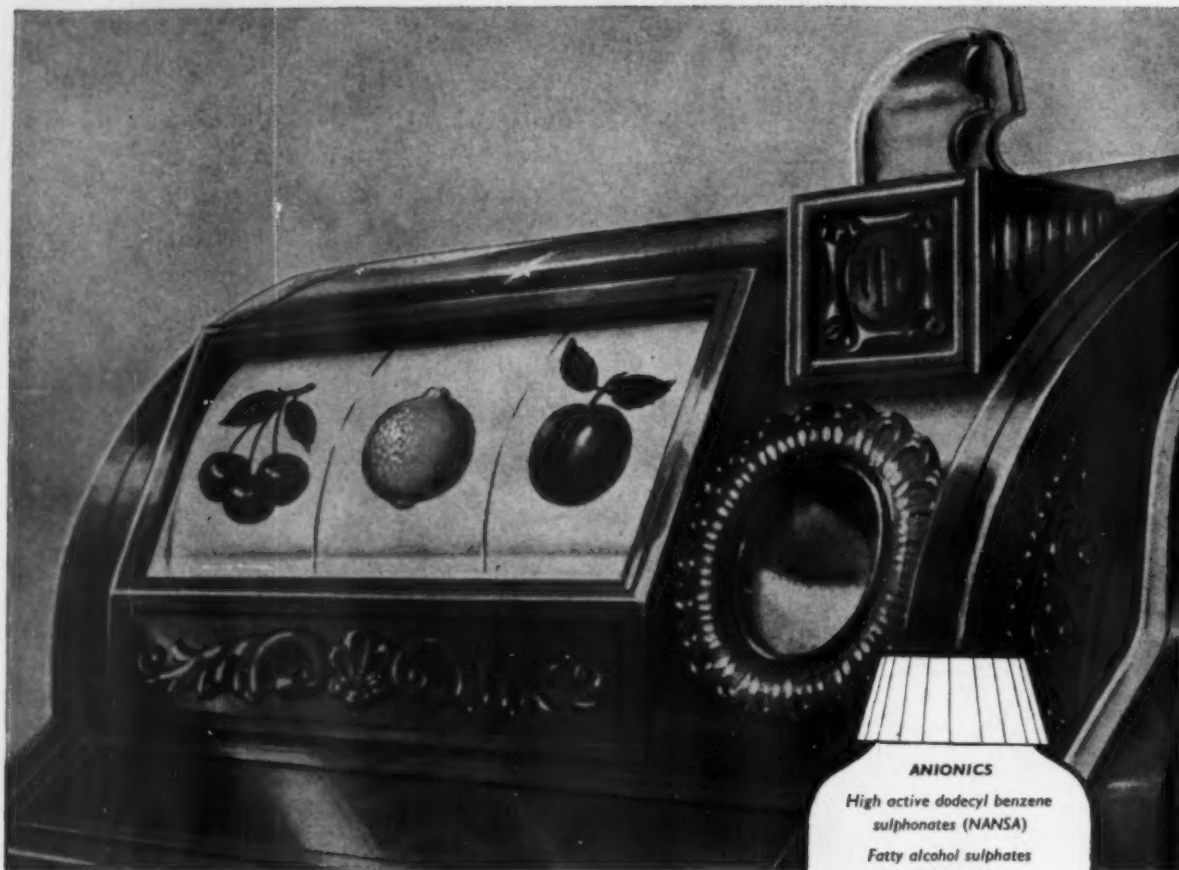
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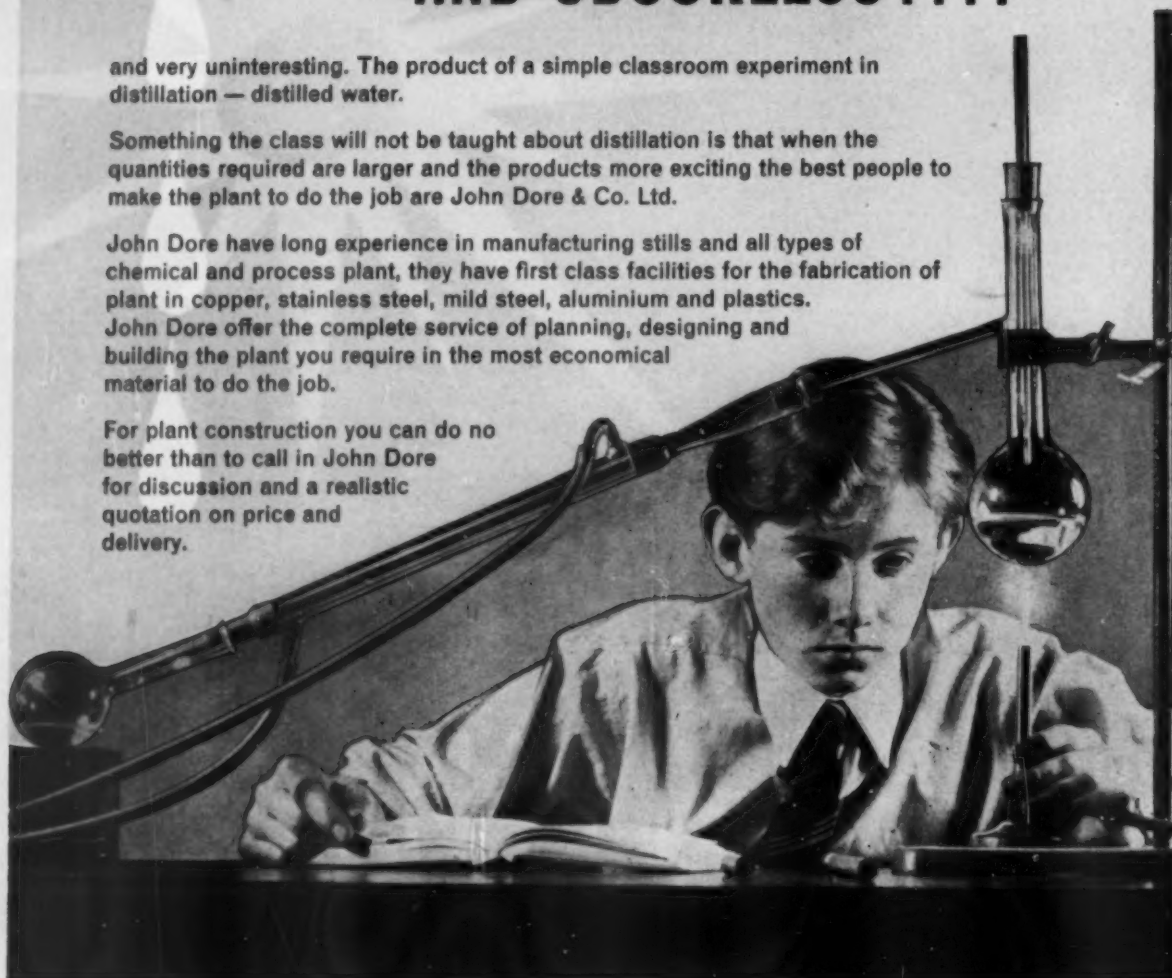
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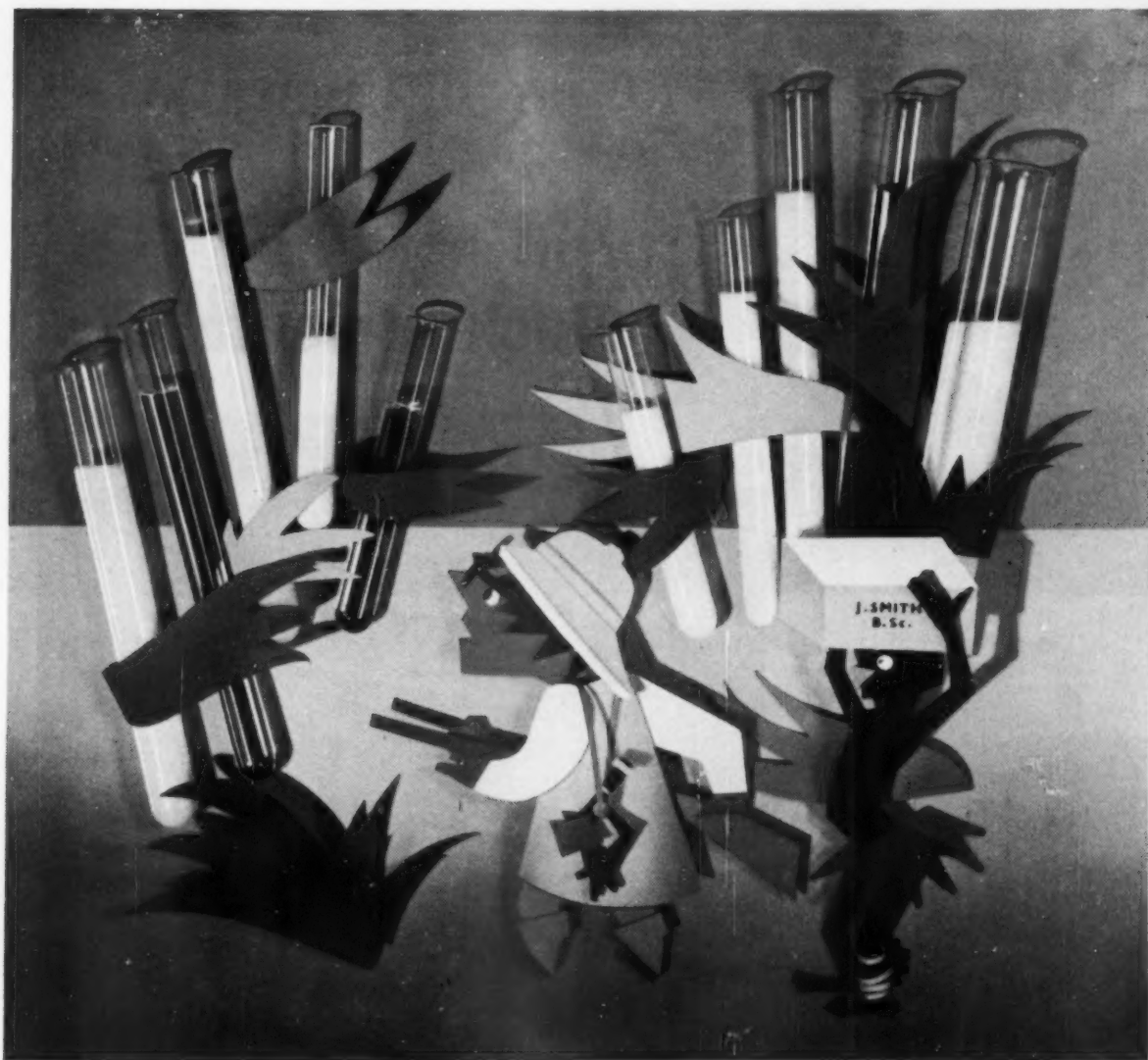
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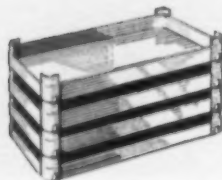
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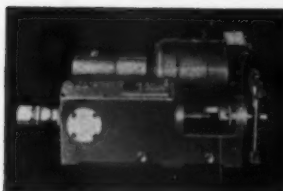
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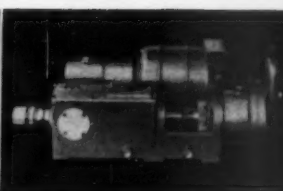
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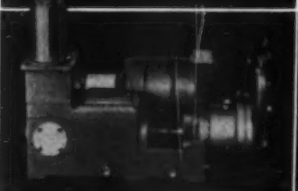
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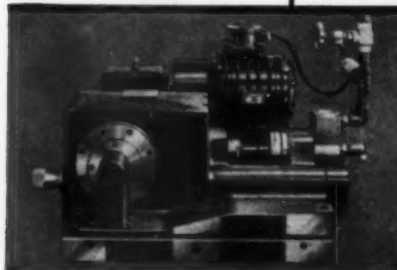
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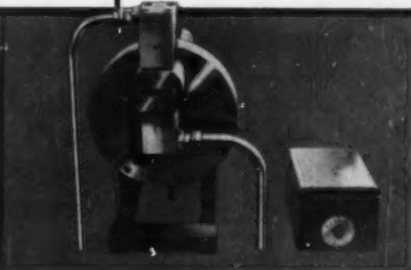


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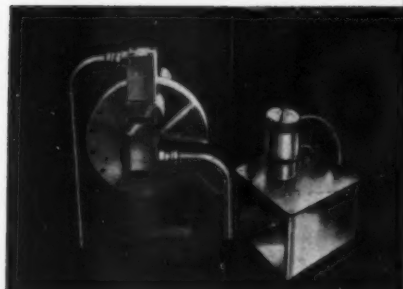
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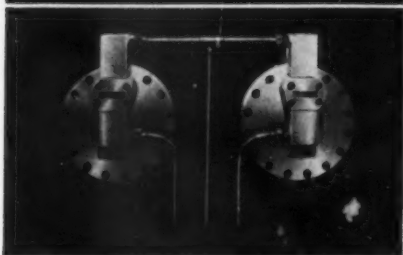
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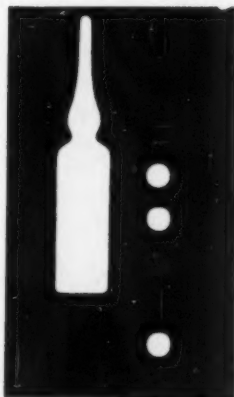
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Manufacturing Chemist

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TOPICS AND COMMENTS

Medicine advertising again

For the second leaflet in their series aimed at improving understanding of the advertising business, the Institute of Practitioners in Advertising have chosen the perennially topical and often maligned subject of proprietary medicine advertising. The leaflet covers well-trodden ground—legal restrictions, the P.A.G.B. code, the British code of standards for advertising medicines and treatments and special restrictions on television advertising. So little in it will be new to the pharmaceutical industry, not that this is a criticism, because the object of the leaflet is to educate advertising people to try to improve their approach to medicine advertising. Though the leaflet is concerned with proprietaries, it would not have been out of place to mention the A.B.P.I. code for ethical which was recently revised, and the code of ethics in advertising imposed on its members by the Pharmaceutical Society.

As is pointed out by the leaflet, modern medicine advertising conforms to vastly higher standards than it did 50 or even 20 years ago. However, the fact remains that many people think it morally wrong to promote medicines in the same way as other articles of commerce. Unfortunately these people are hankering after an impossible Utopia. There is no question that the public finds many proprietaries wholly acceptable and useful and it would be a *reductio ad absurdum* if, in the absence of proprietaries, they had to go to the doctor for every minor ill. Self-medication may be dangerous, but so are many other practices that are popular. There is a limit to which one can go in protecting people against themselves. However, excellent as existing controls and safeguards may be, it is possible to question whether they go far enough. For instance, under existing codes medicines may not be advertised for the treatment of serious ailments requiring medical attention. The question is, when does a trivial ailment become serious? A headache may be trivial, but it may be the sign of something far worse, and repeated palliative treatment may simply worsen the condition by delaying the seeking of medical advice. "The reliable manufacturer," says the leaflet, "will print on his package and/or literature a warning that if symptoms persist a doctor should be consulted." True enough, but why not insist that *all* manufacturers print this warning and in appropriately bold type?

As for the leaflet's comments on prices, how can it be asserted that "The prices of popular medicines today are not felt by the public to be out of line with general price levels." To argue that prices have to cover "scientific advance and product improvement, factory controls and special processes

to ensure purity and reliability" is surely stating the obvious. Unfortunately, as we all know, some manufacturers of proprietaries do little if any research, even if this much abused word is given its widest possible interpretation.

Undoubtedly the proprietaries industry has raised its advertising standards considerably, partly due to enlightened self-interest and partly to the improved education of the public. But there are still loopholes that need plugging and it is in the industry's interest to keep ahead of public opinion in these matters.

Advocate for science

LORD HAILSHAM has started his new job as Minister for Science and Technology by describing what he is not. He is not a super Minister of Education, Power, Transport, Agriculture or Health. He has no more authority than before (as Lord President of the Council) over the Atomic Energy Authority or the great Research Councils like the M.R.C. and the A.R.C. This negative definition of his responsibilities has three purposes. Firstly Lord Hailsham wants to reassure scientists who fear that their jobs and research programmes are going to be drastically upset. Secondly he wants to give the same reassurance to the Universities. Thirdly he wants to disabuse his Cabinet colleagues of any notion that now there is a Minister for Science they have no need to concern themselves with science in their own Departments.

What is Lord Hailsham going to do then? He has said that his two years as Lord President of the Council has convinced him that there is need for a policy for science. That is an intriguing assertion. Science means the systematic pursuit of knowledge and this requires a climate of complete freedom for scientists to originate programmes of research and follow them through. Since this is largely the situation at present and Lord Hailsham has declared that he is not going to interfere with the universities and research councils, what can he mean by a "policy for science"? Does he in fact mean a national policy for applying the results of pure science—a programme of technological priorities? And if so how are priorities to be decided in view of the competing claims of various industries? A national policy for technological innovation will inevitably benefit some industries at the expense of others. Those industries, like chemicals, which have consistently fostered research and invention are likely to be considered able to take care of themselves while the technologically backward industries will be the recipient of Government aid. Since the taxpayer pays for this aid it hardly seems equitable that the slothful should benefit at

the expense of the vigorous. But this would not be something new in Government policy.

Then Lord Hailsham has declared that perhaps all British science is too parochially minded, too departmentalised and lacking in broader vision. Surely specialisation is an inevitable consequence of the snowballing growth of modern science which forces scientists to know more and more about less and less. Does a "broader vision" mean the fashioning of research to serve more practical ends? And if so will this not mean interference with academic freedom?

Perhaps the best that can be said at present about Lord Hailsham's appointment is that it is a powerful piece of publicity for science, dramatising its importance in the minds of the public and thus creating more awareness and greater sympathy for science. This is not a bad thing for a nation that has for too long tended to look down on science and scientists as something associated with dark laboratories and queer smells, long hair and tweed suits.

Even if the post of Minister for Science only encourages more young people to take up science as a career it will have done more than enough to dispel any impression that Lord Hailsham's appointment is political window dressing.

Working for Unilever

For many years science graduates have been able to pick and choose jobs with a facility that must be the envy of men who graduated in the lean twenties and thirties. Even big companies are forced to engage in active recruiting. Some have small teams regularly combing the universities for the best of the successive crops of graduates. Many have issued publications explaining the career possibilities they offer. The latest we have seen is a handsome booklet from Unilever. Its main purpose is to broaden the public image of the company which, of course, identifies Unilever chiefly with soap and margarine. "We work—metaphorically—behind such slogans as 'Omo adds whiteness to brightness' and 'Fancy calling Stork margarine,' and the purist may wonder how—even with first rate facilities—any worthwhile satisfying research could be associated with advertising slogans." Thus says the booklet, and from this point proceeds to enlighten the slogan-bemused reader.

In England Unilever have three main research centres—Port Sunlight (detergents, edible oil products and oil milling), Colworth House near Bedford (food and animal feeding stuffs), and Isleworth, London (dentifrices, shampoos and cosmetics). The work of each of these centres is explained. In addition there are brief descriptions of a dozen current research activities—water conservation with evaporation resistant oleyl alcohol, detergency, polymorphism of fats, dental caries, fluorescent whitening agents, molecular architecture (synthesis

of germicides), preservation of toilet preparations containing non-ionic emulsifiers, development of a shampoo, isolation and identification of food flavours, denaturation of proteins in emulsions, tenderness of cooked vegetables, and early weaning pig food.

"Unilever Research," as the booklet is called, certainly gives an encouraging picture to the keen graduate anxious to make his contribution to science and technology. It also deals with the human side of working for Unilever, such as facilities for recreation and amusement in and near the three research centres. Unfortunately one fundamental human curiosity—namely pay—is not satisfied. Perhaps in the next edition something will be added about the salaries that scientists can expect to earn.

Automatic fire protection

IN THIS issue there are three articles concerned with safety in chemical factories. We have not dealt with one important aspect of safety—that of fire prevention—because this was covered exhaustively in our February issue when we published an article by Dr. Kingman of the Fire Research Organisation, together with a review of equipment for preventing and fighting fires. Nevertheless, it is pertinent to refer in this issue to automatic protection against fire, a subject discussed by the Fire Protection Association in their *Autumn Bulletin*. Automatic protection is a corollary of automation because this leads to large areas of factories being left unattended by workmen. Store-rooms too are frequently void of people.

The Fire Protection Association unequivocally favour sprinkler systems as the best means of automatic fire protection. Although a water sprinkler system which operates when heat is generated in the building may be slower in action than an automatic alarm, it has the virtue of beginning to control the fire as soon as it is detected. However good automatic alarms may be, they can do no more than summon attention, and there must inevitably be some delay. The F.P.A. say that automatic sprinklers should be considered for every building, old and new. They should be considered necessary if any space that can be damaged by a single fire exceeds 250,000 cu. ft. Buildings containing readily combustible contents, or housing unattended or hazardous processes, should also be fitted with sprinklers. Supplementary to water sprinklers are systems using carbon dioxide, foam, dry powder and other special extinguishers. These are usually installed in large plants containing flammable liquids and are often designed for a special hazard.

The F.P.A. quote seven major outbreaks of fire which in their view could have been prevented with automatic sprinklers. Since the losses caused amounted to several million pounds, it is clearly a matter of common commercial prudence to install some form of automatic protection.

Plant makers' ambitions

THE British chemical plant industry is growing up. It is no longer content to be a supplier of bits and pieces of hardware. It wants to get in on process development and process know-how. This is the next and natural aspiration of an industry which is still fairly young but which has great ambitions for the future. The answer is for plant manufacturers and chemical manufacturers to combine their experience and resources so that when, for instance, processes are sold to foreign customers British plant is specified and bought as well as British know-how.

This was one of the interesting themes discussed in two speeches at the annual dinner of the British Chemical Plant Manufacturers Association in London last month. The speakers were the chairman of the association, Mr. H. W. Fender of Prodorite Ltd., and the principal guest, Sir Walter Worboys, who has just retired from I.C.I., where he was commercial director. It is unusual for important matters to be discussed so competently in after-dinner speeches and readers are referred to the summary in our news pages. We understand that the directors of the B.C.P.M.A. and the A.B.C.M. are discussing ways and means of improving collaboration between plant builders and chemical manufacturers. Closer partnership could mark a new phase in the development of these closely related and vitally important industries.

Prophylactic copper

It is a well-known fact that Rhodesians have got copper on the brain, which is reasonable since they live by it. Now they wear it next to the skin as well. Manufacturers of copper products in Salisbury report a big run on copper bangles and circlets which are believed to alleviate a multitude of ills such as rheumatism, arthritis and gout.

Men and women, young and old, are asking for them and the craze has even spread to the Federal Cabinet. During the last session of Parliament the Minister of Law was seen wearing a thin circlet of copper on his wrist. Asked by a fellow member whether it was ornamental or useful, he replied that a friend had recommended copper next to the skin for his spinal complaint. The latest recruit to the copper craze is the Federal Prime Minister, who recently ordered two bangles for rheumatism. It may be that in Rhodesia, where African witchcraft is not far away, European old wives' tales cannot be far behind, but the craze has got the Rhodesian Copper Development Association puzzled. The manager said: "Our job is to publicise the wider use of copper, but we certainly have not started this one. In the past few weeks we have had nearly a hundred enquiries from people wanting copper bangles for rheumatism and other ailments. Some say they have been sent by their doctors. We pass on the enquiries to the manufacturers, who make

them up for 2s. 6d. Some people wear them on their wrists, others on their upper arm above the elbow. Several well-known people in Salisbury are wearing them, and we recently had an order from the Federal Prime Minister for two bangles he commended for rheumatism. The manufacturers are now planning to make them in quantity and to supply them to the shops. The general idea seems to be that copper, being a conductor of electricity, helps to remove surplus electricity from the body. There may be something in it, but it certainly won't start another copper boom at 2s. 6d. an item." Two Rhodesian doctors said that it was the first they had heard of copper being efficacious when applied externally, though it was sometimes applied through the mouth. Meanwhile the copper price remains stable.

First of the new penicillins

MR. H. G. LAZELL, chairman of the Beecham Group, has predicted that within 10 years all penicillins will be made by the process discovered by his chemists at the Beecham Research Laboratories, Brockham Park, Surrey. The confidence needed for such a bold forecast was derived from the occasion of Mr. Lazell's statement—a press conference held to announce the marketing of the first of the new penicillins manufactured by the new process. This is *Broxil*, the potassium salt of 6-(α -phenoxypropionamido) penicillanic acid, the basic molecule of which is 6-amino penicillanic acid, the original modifiable penicillin made by Beechams. *Broxil* has been developed by Bristol Laboratories Inc., the American company with whom Beecham signed an agreement for collaboration in April, just after the announcement of 6-amino penicillanic acid. It was then stated that the object of the link-up was to ensure the quickest possible exploitation of the new discovery. The fact that a new penicillin has been developed, clinically tested and marketed in the astonishingly short period of seven months amply justifies Beechams' commercial strategy. Bristol are calling the product *Syncillin*.

Proxil is marketed in tablet form. For the time being Beechams are importing the drug from Bristol laboratories and are tableting it over here. Later they will manufacture it in their new factory now being built at Worthing which, it is hoped, will be opened towards the end of 1960.

It is claimed that *Broxil* is twice as effective as penicillin V in terms of the concentration achieved in the blood. Blood levels after oral doses of *Broxil* are said to be superior even to those achieved with intramuscular injections of penicillin G. As a result it will be possible to treat by oral administration diseases hitherto responsive only to injections of penicillin. Infections against which *Broxil* has so far proved effective are pharyngitis, laryngitis, boils, some forms of lobar pneumonia and gonorrhoea. It is claimed that no side-effects have been noted apart from those commonly associated with

penicillin administration and that since it is orally effective Broxil is less likely to cause allergic conditions than injected penicillin. The new penicillin is being made available to hospitals in limited supply, but ample supplies are likely in the near future. It costs 105s. per hundred 250 mg. tablets against 72s. for a similar quantity of penicillin V.

Having introduced Broxil, Beechams and Bristol are concentrating on three major objectives: a penicillin suitable for people allergic to current penicillins, penicillins with a wider antibacterial spectrum than present ones, and penicillins which will attack staphylococci resistant to ordinary penicillins. It is thought that Beechams have already made considerable progress towards a broad spectrum penicillin. As for the third objective, they are reputed to have discovered the side chain which, added to 6-amino penicillanic acid, makes penicillin resistant to penicillinase, the enzyme produced by staphylococci which destroys ordinary penicillins.

Beechams are to be congratulated on the success they have achieved so quickly. One other aspect of Broxil which makes it somewhat historic is that for the first time the Americans are paying penicillin royalties to a British firm instead of *vice versa*.

Clearly the possibilities of 6-amino penicillanic acid are enormous and beyond the resources of one or even two firms to exploit. It would not be surprising if Beechams licensed a British manufacturer to participate in the discovery. Mr. Lazell hinted as much at his press conference.

Fibreboard bulk containers

GREATER use is now being made of the fibreboard case as a bulk container instead of merely acting as a retainer for shipping a number of smaller packages.

Improved types of fibreboard drums have appeared in recent years to replace light gauge metal drums and are in competition with paper sacks. Like paper sacks, printing is cheap and can be made attractive, and aluminium or bitumen laminated plies can be incorporated. Combined with these barrier linings their smooth interiors are suitable for hygroscopic and deliquescent products.

Attractions of the fibreboard drum include the low weight and a cost less than the equivalent size of light metal drum.

The principles of good packaging are simple and obvious, and to go beyond fundamentals lands one into a mass of detailed individual studies. If given the technical and economic facts, those skilled in packaging techniques can advise on the most likely packs. Laboratory tests and experimental shipments will give the final answer.

Packaging problems of the industry include the development of low cost, light-weight drums, application of corrosion-resistant lining materials, and further exploitation of multiwall paper sacks and economic plastic containers.

Relief for bronchitics

CHRONIC bronchitis is reputed to cost Britain £60 million a year in lost production and sickness benefit. Certainly it is a widespread and distressing disease which, during the winter months, seriously disables thousands of people. Antibiotics like tetracycline have done much to reduce the severity of bronchitis. Now a new treatment has been introduced for diluting the thick sputum, the ejection of which is the bronchitic's greatest problem. It is a mucolytic enzyme—chymotrypsin—which is presented as an ultra-fine powder in the size range 2-6 μ . It is claimed that particles of this size can reach the extremities of the lung and cause the enzyme to have prompt effect upon the sputum, making it much easier and less painful to "cough up." In combination with this treatment another is given, namely the bronchodilator, isoprenaline. Thus anti-spasmodic and mucolytic therapies are combined.

The manufacturers of these new products are Benger Laboratories Ltd. Last winter they distributed samples to 60 general practitioners who tried them on 200 chronic bronchitics. According to a report by Carnachan and Bendall in the *British Journal of Clinical Practice*, October 1959, 70.9% showed overall subjective improvement.

Benger call the enzyme preparation *Lomudase* and the bronchodilator *Lomupren*. The common prefix is intended to indicate the extreme fineness of the powders. It is claimed that 80% are in the range 2 to 6 μ . How this degree of size reduction was achieved is not revealed by Bengers except that conventional grinding and sieving methods were inadequate for the job. Of equal technical interest is the disperser which Bengers designed to ensure that the fine powders could be drawn deeply into the lungs. This is called the *Lomulizer*. A smaller cartridge containing the powder is placed into the nozzle of the disperser, which is then placed in the mouth. The patient breathes in and squeezes the air bulb at the same time. The patient must suck and squeeze simultaneously. Unless he does this he cannot eject the powder. The secret is a small valve which does not open unless the patient makes an inspiratory effort. This device ensures that the fine powders do in fact penetrate the lungs.

Bengers not only designed this ingenious dispenser. They also make it—their first essay in plastics fabrication.

Chemical Pumps

A guide to chemical pumps will appear in next month's *MANUFACTURING CHEMIST*. There will be a special assessment of chemical pumps by Dr. W. F. Riester and a review of pumps and associated equipment. Another feature of December will be a review of current vitamin products by G. R. Wilkinson of Allen and Hanburys.

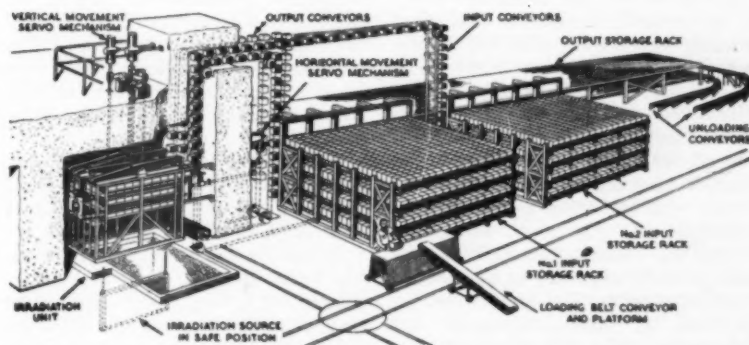
THE OUTLOOK FOR "COLD" STERILISATION *The prospect of an irradiation sterilisation plant being available soon to British industry renews interest in the possibilities of sterilising pharmaceutical and medical products by gamma rays. Here is a special MANUFACTURING CHEMIST guide to atomic sterilisation. In the first article a scientist working at Wantage, where the new irradiation plant is being built, clarifies current authoritative thinking on gamma ray sterilisation of pharmaceuticals and hints at the views likely to be put forward in the special report expected from the Association of British Pharmaceutical Industry. In the second article a detailed description is given of how Ethicon Incorporated started up a commercial sterilisation plant for sutures.*

Radiation Sterilisation of Pharmaceuticals

By D. B. Powell,* B.Sc., PH.D.

INVESTIGATION of the effects of ionising radiation on bacteria started very early after the discovery of X-rays by Roentgen in 1895. It was not until 1919, however, that the bactericidal effect of this form of radiation was demonstrated and it remained of academic interest only until the recent technological development of atomic energy made it possible to consider this technique for exploitation on an industrial scale. Most of the research work in the last decade has been beamed at applications to the food industry and little attention has been given to the sterilisation of medical equipment and pharmaceutical products. This situation has in some ways been rather unfortunate because the sterilisation of inert materials and pure chemicals is not handicapped by the many problems that are associated with the application of radiation to food. At sterilisation doses very few materials are affected to any degree, and with a pure chemical or a composition of such chemicals it is relatively easy to determine any change in structure and properties.

Gamma radiation has several unique properties which make it very suitable as a method of sterilisation. First there is its ability to penetrate deeply into any material so that the gamma rays from cobalt 60 will penetrate 6 or 7 in. in water before the intensity of the radiation is reduced by half. This penetration is approximately proportional to the density of the material and this is illustrated by the fact that to reduce the intensity of radiation to 10% would require 2 in. of lead or some 2 ft. of water. Because of the considerable penetrative power of



The irradiation plant being built at Wantage, Berks. The cell has been designed to house half a million curies of cobalt 60, but will be loaded initially with 150,000 curies which will provide a throughput of up to 7 Megarad-tons per day. In 24 hr. up to 3 tons of medical product could be rendered sterile, since a sterilising dose is of the order of 2½ rads. A similar plant is approaching completion near Melbourne, Australia, for the sterilisation of goat's hair for carpet manufacture.

gamma radiation, the choice of materials for sterilisation is considerable and also very large packages can be treated intact, although the packages must be irradiated from both sides in order to get a homogeneous intensity of radiation dose. A second property of gamma radiation which is of particular value is that the treatment is accomplished with a negligible rise in temperature; it is in fact a cold method of sterilisation. This again provides great freedom in the choice of materials and allows the sterilisation of products packed in plastic materials which are heat-sensitive. There are also several pharmaceutical items now being marketed in aerosol cans and, if it was desirable to sterilise the finished product, gamma radiation could be used to sterilise the container as a penetrative and cold method of sterilisation would be required. Glass, however, one of the major container materials used in the pharmaceutical industry, is visibly affected by irradiation

in that all the common glasses change colour to some extent, generally to brown. The glass can be stabilised to irradiation by the addition of cerium oxide to the mix, but this resistant glass would probably be expensive unless there was a considerable demand for it. Nevertheless, the change in colour might not be a serious disadvantage as clarity is not impaired, and it has been suggested that the change in colour might be used as an indication that the container had been sterilised.

Radiation doses

Micro-organisms show a wide range of susceptibilities to ionising radiation, but before indicating the effective range of doses it is useful to define the units of radiation dose. The original unit still in current use is the roentgen which defines the dose in air from X-rays or gamma radiation in relation to the amount of ionisation produced. This ionisation results in the deposition of

* Technological Irradiation Group, Isotope Research Division, Wantage Radiation Laboratory, Wantage, Berks.

penicillin administration and that since it is orally effective Broxil is less likely to cause allergic conditions than injected penicillin. The new penicillin is being made available to hospitals in limited supply, but ample supplies are likely in the near future. It costs 105s. per hundred 250 mg. tablets against 72s. for a similar quantity of penicillin V.

Having introduced Broxil, Beechams and Bristol are concentrating on three major objectives: a penicillin suitable for people allergic to current penicillins, penicillins with a wider antibacterial spectrum than present ones, and penicillins which will attack staphylococci resistant to ordinary penicillins. It is thought that Beechams have already made considerable progress towards a broad spectrum penicillin. As for the third objective, they are reputed to have discovered the side chain which, added to 6-amino penicillanic acid, makes penicillin resistant to penicillinase, the enzyme produced by staphylococci which destroys ordinary penicillins.

Beechams are to be congratulated on the success they have achieved so quickly. One other aspect of Broxil which makes it somewhat historic is that for the first time the Americans are paying penicillin royalties to a British firm instead of *vice versa*.

Clearly the possibilities of 6-amino penicillanic acid are enormous and beyond the resources of one or even two firms to exploit. It would not be surprising if Beechams licensed a British manufacturer to participate in the discovery. Mr. Lazell hinted as much at his press conference.

Fibreboard bulk containers

GREATER use is now being made of the fibreboard case as a bulk container instead of merely acting as a retainer for shipping a number of smaller packages.

Improved types of fibreboard drums have appeared in recent years to replace light gauge metal drums and are in competition with paper sacks. Like paper sacks, printing is cheap and can be made attractive, and aluminium or bitumen laminated plies can be incorporated. Combined with these barrier linings their smooth interiors are suitable for hygroscopic and deliquescent products.

Attractions of the fibreboard drum include the low weight and a cost less than the equivalent size of light metal drum.

The principles of good packaging are simple and obvious, and to go beyond fundamentals lands one into a mass of detailed individual studies. If given the technical and economic facts, those skilled in packaging techniques can advise on the most likely packs. Laboratory tests and experimental shipments will give the final answer.

Packaging problems of the industry include the development of low cost, light-weight drums, application of corrosion-resistant lining materials, and further exploitation of multiwall paper sacks and economic plastic containers.

Relief for bronchitics

CHRONIC bronchitis is reputed to cost Britain £60 million a year in lost production and sickness benefit. Certainly it is a widespread and distressing disease which, during the winter months, seriously disables thousands of people. Antibiotics like tetracycline have done much to reduce the severity of bronchitis. Now a new treatment has been introduced for diluting the thick sputum, the ejection of which is the bronchitic's greatest problem. It is a mucolytic enzyme—chymotrypsin—which is presented as an ultra-fine powder in the size range 2-6 μ . It is claimed that particles of this size can reach the extremities of the lung and cause the enzyme to have prompt effect upon the sputum, making it much easier and less painful to "cough up." In combination with this treatment another is given, namely the bronchodilator, isoprenaline. Thus anti-spasmodic and mucolytic therapies are combined.

The manufacturers of these new products are Bengel Laboratories Ltd. Last winter they distributed samples to 60 general practitioners who tried them on 200 chronic bronchitics. According to a report by Carnahan and Bendall in the *British Journal of Clinical Practice*, October 1959, 70.9% showed overall subjective improvement.

Bengel call the enzyme preparation *Lomudase* and the bronchodilator *Lomupren*. The common prefix is intended to indicate the extreme fineness of the powders. It is claimed that 80% are in the range 2 to 6 μ . How this degree of size reduction was achieved is not revealed by Bengers except that conventional grinding and sieving methods were inadequate for the job. Of equal technical interest is the disperser which Bengers designed to ensure that the fine powders could be drawn deeply into the lungs. This is called the *Lomulizer*. A smaller cartridge containing the powder is placed into the nozzle of the disperser, which is then placed in the mouth. The patient breathes in and squeezes the air bulb at the same time. The patient must suck and squeeze simultaneously. Unless he does this he cannot eject the powder. The secret is a small valve which does not open unless the patient makes an inspiratory effort. This device ensures that the fine powders do in fact penetrate the lungs.

Bengers not only designed this ingenious dispenser. They also make it—their first essay in plastics fabrication.

Chemical Pumps

A guide to chemical pumps will appear in next month's *MANUFACTURING CHEMIST*. There will be a special assessment of chemical pumps by Dr. W. F. Riester and a review of pumps and associated equipment. Another feature of December will be a review of current vitamin products by G. R. Wilkinson of Allen and Hanburys.

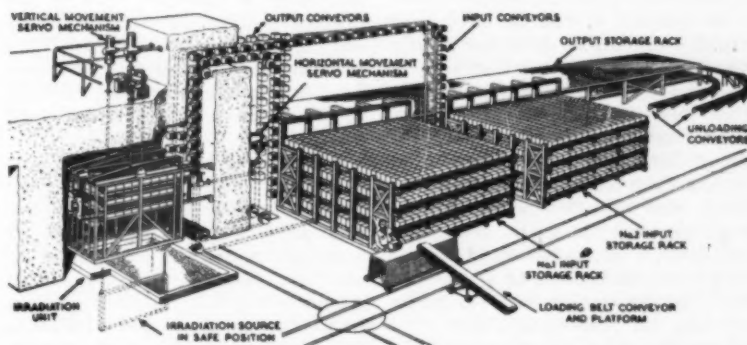
THE OUTLOOK FOR "COLD" STERILISATION *The prospect of an irradiation sterilisation plant being available soon to British industry renews interest in the possibilities of sterilising pharmaceutical and medical products by gamma rays. Here is a special MANUFACTURING CHEMIST guide to atomic sterilisation. In the first article a scientist working at Wantage, where the new irradiation plant is being built, clarifies current authoritative thinking on gamma ray sterilisation of pharmaceuticals and hints at the views likely to be put forward in the special report expected from the Association of British Pharmaceutical Industry. In the second article a detailed description is given of how Ethicon Incorporated started up a commercial sterilisation plant for sutures.*

Radiation Sterilisation of Pharmaceuticals

By D. B. Powell,* B.Sc., PH.D.

INVESTIGATION of the effects of ionising radiation on bacteria started very early after the discovery of X-rays by Roentgen in 1895. It was not until 1919, however, that the bactericidal effect of this form of radiation was demonstrated and it remained of academic interest only until the recent technological development of atomic energy made it possible to consider this technique for exploitation on an industrial scale. Most of the research work in the last decade has been beamed at applications to the food industry and little attention has been given to the sterilisation of medical equipment and pharmaceutical products. This situation has in some ways been rather unfortunate because the sterilisation of inert materials and pure chemicals is not handicapped by the many problems that are associated with the application of radiation to food. At sterilisation doses very few materials are affected to any degree, and with a pure chemical or a composition of such chemicals it is relatively easy to determine any change in structure and properties.

Gamma radiation has several unique properties which make it very suitable as a method of sterilisation. First there is its ability to penetrate deeply into any material so that the gamma rays from cobalt 60 will penetrate 6 or 7 in. in water before the intensity of the radiation is reduced by half. This penetration is approximately proportional to the density of the material and this is illustrated by the fact that to reduce the intensity of radiation to 10% would require 2 in. of lead or some 2 ft. of water. Because of the considerable penetrative power of



The irradiation plant being built at Wantage, Berks. The cell has been designed to house half a million curies of cobalt 60, but will be loaded initially with 150,000 curies which will provide a throughput of up to 7 Megarad-tons per day. In 24 hr. up to 3 tons of medical product could be rendered sterile, since a sterilising dose is of the order of 2½ rads. A similar plant is approaching completion near Melbourne, Australia, for the sterilisation of goat's hair for carpet manufacture.

gamma radiation, the choice of materials for sterilisation is considerable and also very large packages can be treated intact, although the packages must be irradiated from both sides in order to get a homogeneous intensity of radiation dose. A second property of gamma radiation which is of particular value is that the treatment is accomplished with a negligible rise in temperature; it is in fact a cold method of sterilisation. This again provides great freedom in the choice of materials and allows the sterilisation of products packed in plastic materials which are heat-sensitive. There are also several pharmaceutical items now being marketed in aerosol cans and, if it was desirable to sterilise the finished product, gamma radiation could be used to sterilise the container as a penetrative and cold method of sterilisation would be required. Glass, however, one of the major container materials used in the pharmaceutical industry, is visibly affected by irradiation

in that all the common glasses change colour to some extent, generally to brown. The glass can be stabilised to irradiation by the addition of cerium oxide to the mix, but this resistant glass would probably be expensive unless there was a considerable demand for it. Nevertheless, the change in colour might not be a serious disadvantage as clarity is not impaired, and it has been suggested that the change in colour might be used as an indication that the container had been sterilised.

Radiation doses

Micro-organisms show a wide range of susceptibilities to ionising radiation, but before indicating the effective range of doses it is useful to define the units of radiation dose. The original unit still in current use is the roentgen which defines the dose in air from X-rays or gamma radiation in relation to the amount of ionisation produced. This ionisation results in the deposition of

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energy in the air, but whereas a quantity of radiation which produces one roentgen deposits about 88 ergs per gram in air, the same quantity of radiation deposits about 98 ergs per gram in biological tissue. This latter dose is known as the roentgen equivalent physical or rep. It is in some ways inconvenient to have units of dose that depend on the material in which the radiation is absorbed, and for this reason an internationally recognised unit in current use is the rad, which is an arbitrary unit corresponding to absorption of 100 ergs per gram regardless of the absorbing material. (1 Megarad equals one million rads.)

In general it can be said that rapidly developing cells are highly sensitive to radiation so that vegetative bacteria are more sensitive than bacterial spores. Although this effect is similar to that produced by heat, it is incorrect to regard heat-resistant organisms as being also radiation resistant. An example of this is *B. stearothermophilus*, which is resistant to heat and is currently used as a standard for heat sterilisation, but is killed by a dose of radiation below 1.5 Megarads. The following will give an idea of the doses of radiation required to kill various micro-organisms:

Dose (Megarad)	Organism
0.1-0.5	<i>Staph. aureus</i> , <i>Pseudomonas pyocyanus</i>
0.5-1.0	<i>E. coli</i> , <i>Strep. faecalis</i> , <i>Strep. viridans</i>
1.0-1.5	<i>B. thermacidurans</i>
1.0-2.0	<i>B. stearothermophilus</i> , <i>B. anthracis</i> , <i>B. megatherium</i>
1.5-2.5	<i>Clostridium welchii</i> , <i>B. subtilis</i> , <i>C. tetani</i>

It should be realised that these doses are an indication of those which might be used on a commercial scale; for each product the dose would be determined by the initial contamination, the physical state of the product, and the degree of "sterility" required. There is an exponential relationship between kill and dose, so that it is possible to determine reduction factors for all organisms at any dose level. For example, to give a final count of one spore in 10^6 samples of a dry product starting with 10^6 spores of *B. subtilis* per sample a dose of 2.05 M.rad would be required, but one containing 10^4 spores per sample would require 1.75 M.rad to give a similar final count. A product which came off the production line in a very clean state, containing say 10

spores per sample, would need only 1.3 M.rad.

Results of A.B.P.I.—Wantage study

The only major study of the effects of irradiation on pharmaceutical products carried out in this country has been the co-operative programme between the Technological Irradiation Group of Wantage Radiation Laboratory, the School of Pharmacy, University of London and the Association of British Pharmaceutical Industry. The results of this work, which will be published in the near future, indicate that the technique of radiation sterilisation cannot be applied to all products and will only find specific applications to items that are not degraded in any way by the treatment and are difficult to sterilise by conventional heat methods.

Considering products that are difficult to sterilise at the present time, the two types of products that are a problem to deal with are suspensions and powders. Solutions can be filtered and aseptically assembled in final distribution units so that an application of a radiation technique to sterilise such solutions would have to show either some economic advantage over existing methods or an improvement in the degree of sterility now attained. It is not conceivable that any firm would scrap an existing plant with subsequent loss of capital investment in order to change over to a new technique involving further capital outlay unless the new method gives considerable benefits. It may, however, be well worth while sterilising solutions, which are satisfactory at the present time, by irradiation if there was in existence a radiation plant dealing with materials difficult to sterilise. It is essential, therefore, to have knowledge of the effects of irradiation on such solutions for future reference. The most immediate application, however, is to heat-sensitive suspensions and powders.

Irradiation effects on pharmaceuticals

American work has shown that a radiation-sterilised polyvitamin preparation containing thiamine, riboflavin, pyridoxin, calcium pantothenate, nicotinamide, folic acid and vitamin B₁₂ exhibited no change in activity or in acute toxicity after four years' storage at 25°C. In aqueous solution, however, these compounds show some loss in

activity. Vitamin C does not appear to be adversely affected by irradiation, but in solution there is again some loss in activity. A solution of vitamin C can be sterilised in the frozen state, however, without change. The American work also indicates that antibiotics such as penicillin and streptomycin salts can be successfully irradiated in the dry form or in oil and suspensions.

Work in this country generally supports this finding, but there is a tendency for most of these compounds to be slightly affected in colour by sterilisation doses. This tendency to browning is almost certainly due to induced oxidation effects which can be overcome by either packing in vacuum or under nitrogen. This change in colour has been a general objection to irradiation, but it would be well worth while investigating the feasibility of the alternative methods of packing suggested where this trouble occurs.

Progesterone, prednisolone and cortisone can be sterilised successfully in the solid state and American work claims that these compounds are also stable in suspension. Ergometrine maleate and morphine sulphate can also be sterilised in the solid state, but are degraded to some extent in solution. Atropine sulphate and heparin in both solid and solution are adversely affected by irradiation as are the organo-metallic compounds. American work claims that hormones such as testosterone, pituitary hormone, oestradiol and insulin can be successfully treated, but in this country work on insulin and protamine zinc insulin shows there is considerable loss in activity.

Dry powders of two proteolytic enzymes, ficin and Maya protease, have been sterilised on a routine basis in America with success. These preparations are being used clinically for wound debridement. Tale, which is used on a large scale in the pharmaceutical industry, can also be successfully sterilised. The same of course can be said for hospital supplies such as dressings, gauze, bandages and swabs. Adhesive bandages can also be sterilised, if suitable adhesives are used, and special bandages impregnated with heat-sensitive compounds, which are very difficult to sterilise, could be treated as long as the incorporated compounds were not sensitive to irradiation. Each of these

articles would have to be investigated to determine the success or otherwise of irradiation sterilisation.

Cost of radiation sterilisation

It is very difficult to cost a process in general terms, for it is necessary to know first of all the size of the plant and source required, which of course will be determined by the throughput to be sterilised. We can, however, take an example to give some idea of what is involved when a plant is designed for a specific product. If we require to process 2.4×10^6 lb. p.a. at a radiation dose of 2.5 megarad, then the source required would be about 200,000 curies of cobalt 60 using an operating time of 8,000 hr. p.a. Assuming that the shielding to house the source and the mechanical handling equipment to handle the throughput would cost about £50,000 and that the cost of the source would be a further £50,000 then a capital outlay of the order of £100,000 would be involved. In the absence of operating experience, only estimates of operating cost are possible. A suitable basis for

calculating capital charges might be 15% depreciation plus 5% interest on capital during the period of depreciation. In addition 12½% p.a. should be added for replacement of the irradiation source. These charges with labour, maintenance and overheads might give an annual operating cost of the order of £40,000. The unit cost would then be approximately 4d. per lb. Costs will of course be lower for higher throughputs and *vice versa*. This is probably a reasonable assessment of costs but actual costs will be determined also by the efficiency at which the plant is operated for each individual application. Experimental plants which need to be versatile are consequently less efficient.

The Wantage plant

An experimental package irradiation plant is now in construction at Wantage and is likely to be operating by the end of the year. This plant is designed to house 500,000 curies of cobalt 60, but will be initially loaded with 150,000 curies. This size source will process about 180 cubic foot cartons

at a dose of 2.5 Megarads per day. The plant will be available to commercial concerns in this country who wish to sterilise large quantities of material for market trials, etc. The considerable interest shown in this country by manufacturers of medical equipment such as plastic syringes, petri dishes, prostheses, instruments, catheters, dressings, etc., ensures that this plant will be put to good use.

It is seen, therefore, that the irradiation technique is no longer a method of sterilisation of academic interest only, but is now with us on an increasing scale. The fear is sometimes expressed that there will be residual radioactivity in materials that have been subjected to gamma radiation. However, it can be categorically stated that cobalt 60 gamma rays or any other gamma rays of similar or lower energy cannot and will not produce residual radioactivity. In conclusion it may be said that gamma radiation provides a new, safe and effective means of carrying out sterilisation of a wide variety of materials and its adoption is likely to be widespread in the immediate future.

Radiation Sterilisation of Surgical Sutures

One of the first commercial applications found for atomic radiation is the sterilising of packed surgical catgut sutures. A five-year development project by Ethicon Inc. in the U.S. has showed that while radiation is more expensive than heat treatment, a better product is obtained.

A RESEARCH programme undertaken by the U.S. Ethicon company has shown that atomic radiation can be used satisfactorily to sterilise surgical sutures. In this case the cost is higher than the more conventional heat sterilisation, but it has been possible to produce a better package and to introduce simpler manufacturing processes.

Now machine produced radiation is being used for the routine sterilisation of sutures. A special building has been erected to house the radiation source, and the product, in trays on a conveyor, passes through the radiation zone before dispatch.

Catgut sterilisation

Surgical sutures are of two main types, the absorbable and the non-

absorbable. The former, known as "catgut," is derived from connective tissue layers of beef and sheep intestines. Catgut has always presented formidable problems of sterilisation because it consists of the animal protein collagen and is damaged by heat, resulting in a product with reduced tensile strength, pliability and other important properties.

The "conventional" way of processing is to dehydrate the catgut sutures by heating at 100°-110°C. for 8-12 hr., immersing them in an anhydrous hydrocarbon bath and then sterilising at 156°C. for an hour. Subsequently, under aseptic process conditions, the containers are filled with sterile tubing fluid, to rehydrate the sutures, and finally sealed.

Heat sterilised sutures are always packed in glass tubes because glass is the only economical packing material suitable for the high sterilising temperatures. However, glass represents a hazard, for the glass containers must be broken to open them immediately before the suture is used.

Besides all the factors against heat sterilisation there is the most important point that it is a batch operation, and the trend today is towards continuous processing with the application of automatic plant control.

Thus it was considered desirable to find a new method of sterilisation which would cause minimum damage to the sutures; permit sterilisation to be carried out on the final, sealed package; allow the use

of a better and more convenient container, which would lend itself to continuous working.

Research project

As early as 1949 it had been established that atomic radiation is capable of killing micro-organisms at comparatively low dose levels. While some work was done to evaluate the dose rates needed for the sterilisation of different types of materials, the large capital outlay required and the lack of previous experience deterred most industries from undertaking development programmes.

Early in 1953, however, Ethicon decided to investigate the feasibility of sterilising catgut sutures by radiation.

The first step was to determine the amount of radiation needed to sterilise the catgut and the amount which would cause serious damage to the sutures. As a radiation source a small Van de Graaff particle accelerator (see below) was hired from the U.S. High Voltage Engineering Corp. Over 150 different types of micro-organisms were irradiated to find the minimum complete sterilising dose.

It was shown that 2.5 megarads (a rad is a measure of dose and equals 100 ergs of energy absorbed by one gram of material) would be a suitable sterilising dose because it was at least 40% greater than the minimum necessary to kill the most resistant organism. The catgut suture could receive 5 megarads before its properties deteriorated below the level of the heat-sterilised product.

After this work the requirements for production line working were determined. A radiation source had to be found which would give radiation of sufficient energy to penetrate the product completely and which would have sufficient power to allow the required amount of product to be treated. For commercial processing it was established that the radiation in the energy range 4-7 M.e.V. (1 M.e.V.—million electron volts—is the amount of energy an electron would acquire in passing through a potential gradient of one million volts) was needed from a source with a power output of 2.5-3.0 kilowatts.

Radiation sources

In theory there are many possible sources of radiation for processing.

In fact most of them can be ruled out either because of cost, energy and power level, or lack of experience in use.

The nuclear reactor is a source of atomic radiation, but the cost of a unit is immense. However, plans have been made for using the radioactive coolant from a power producing reactor as a radiation source by flowing it through an external loop passing through an irradiation building. This would mean, of course, that the processing plant would have to be sited next to a nuclear power station.

Spent or irradiated fuel rods from a reactor have been suggested as convenient radiation sources. Normally the spent elements are taken from a reactor and stored under water for some six months to allow the intense initial radiation to die away: it is suggested that they be used for irradiation work during this cooling period. Tests are being made in some countries on this idea. In France irradiated fuel rods from the EL3 reactor are allowed to cool in special irradiation chambers so that their energy can be utilised.

However it is apparent that to use the rods in a processing factory the cost of transport would be high, especially as the power output from single rods is comparatively small.

Other suggested sources of radiation are the radioactive elements. Some of these are made specially by "baking" materials in a nuclear reactor, while others will come as by-products from the fuel rod reprocessing plants. By careful selection of the radioactive element, radiation of the required energy level could be obtained, but to get the power level required huge quantities of material would be needed. It is estimated that 70,000 curies (a curie is a measure of the number of radioactive disintegrations occurring in an element in unit time) of cobalt 60 would be needed to give one kilowatt of radiation.

Large quantities of radioactive material will become available as the nuclear power programme builds up.

At the time of the Ethicon investigation the only suitable sources were radiation machines—devices which produce the elementary particles and then accelerate them up to the desired energy level before sending a beam of particles out as required.

Acceleration machines

Radiation producing machines were developed for basic physics research into atomic structure. The earliest machine designed by Cockcroft and Walton was a small, crude device, but since those early days bigger units have been built. Present-day research machines cost millions of pounds. For processing work, however, small machines are available at comparatively reasonable cost.

The most common machines for this work are the linear accelerator and the Van de Graaff accelerator.

In the Van de Graaff machine atomic particles are accelerated by injecting them into a potential gradient, this potential gradient being produced by raising a terminal inside the machine to a high potential with respect to the rest of the machine. This is done by spraying charge on to a rapidly moving insulated belt which carries it up into the insulated terminal. Charge is built up to a controllable level and prevented from discharging by keeping the whole machine inside a pressure tank containing high-pressure nitrogen.

If the particles required are electrons, a device like the electron gun in a television tube is used in which particles are evaporated from a heated wire. Electrons leaving the source are accelerated down a guiding tube earthed at its base and pass out through a sealing window.

The issuing beam of particles can be "shaped" and adjusted by scanning coils (see figure).

In the linear accelerator, particles are produced in a similar way, but instead of an accelerating potential gradient there is a travelling, high frequency, electromagnetic wave. The wave travelling inside a tube which acts as a guide picks up particles in "bunches," accelerates them, and a beam is issued from the machine.

Again as in the Van de Graaff the electron beam is shaped by scanning coils.

Both types of machine are made in various sizes and models differing in energy of particles produced, power level available, etc. The beam current measures the power level and determines the production capacity because it governs the rate at which the product can be passed through the beam so that it receives the required dose.

The Ethicon plant

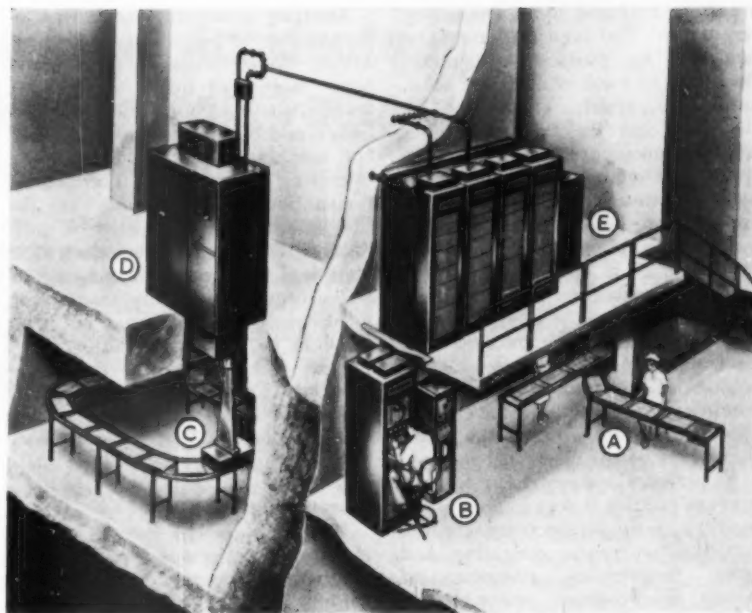
Ethicon's study of the available machines indicated that a linear accelerator (commonly known as a "linac") was the most suitable for suture sterilisation because it could supply adequate power and the correct energy particles, and the machine itself is comparatively small. The company now has a linac and a 2 M.e.V. Van de Graaff machine, used for research work, and is installing a 3 M.e.V. Van de Graaff machine for further work.

It was decided to house both the Van de Graaff and the linac in a new building close to the older sterilisation plant so that a logical flow of material through the manufacturing operations would be maintained after the changeover. The accelerator building is separated from the main manufacturing building but connected by an enclosed passage. This allows for future expansion of the manufacturing area without upsetting the process flow.

A split-level accelerator building (see illustration) was erected. On the lowest level, partly underground, there are two irradiation rooms each surrounded by 7 ft. of concrete—the depth of shielding was calculated on the basis of the most penetrating radiation likely to be produced by the electrons hitting the conveyor belt or other objects. The next level, half a story higher, contains the target rooms, the production area where the conveyor is loaded and unloaded, the operating consoles and the monitors. On the next level, some 3 ft. higher, the accelerators are housed, while the top level, a balcony floor, holds the power packs and high-frequency amplifiers for the machines. Maintenance facilities are also kept on this top level.

Safety

The complete installation is designed for maximum safety. The passage leading to the accelerator rooms and target rooms has two right-angled turns so that all stray radiation is effectively blocked. Shielding is designed for almost complete absorption of all radiation. Doors leading to radiation areas are locked and also interlocked so that if they are opened the machines are turned off automatically. (With radiation machines there is no residual activity once they have been switched off.) On starting the machines there is a short delay:



A split-level building houses Ethicon's linac. Loading and unloading of conveyor (A) takes place beside controls (B). Trays of sutures move to the irradiation room at lower level (C) to pass under electron beam from linac (D). Power supplies and maintenance workshop are on mezzanine (E).

during this time a horn sounds repeatedly as a warning. During operations the target rooms can be inspected through a maze-and-mirror system.

The highest radiation level detected in areas normally occupied by personnel was less than 0.5 milliroentgen per hour and is usually less than one-tenth of this (the roentgen, like the rad, is a measure of radiation dose).

Monitoring

As the company cannot afford a single case of lack of sterility in its sutures, the most careful monitoring is carried out. Really it is essential to check dose, the beam width or scan, and the beam penetration all the time processing is under way. It would be ideal if all factors could be monitored continuously, but it is not feasible and frequent intermittent checks are made. However, the machines are checked to make sure they are working properly and there are checks on the processing submitted to each tray of products. Finally samples are tested for complete sterilisation.

In the control of machine parameters the linac is more of a problem than the Van de Graaff type of machine. In the latter device the controls are fairly simple.

Beam current and scanning coil currents can be read directly on ammeters, while the accelerating voltage, a very stable thing, can be measured on an electrostatic voltmeter.

After determining the maximum allowable variation in each of these three important parameters, it is possible to feed the output from the meters into a computer circuit. This circuit could then give a signal whenever the irradiation dose drops below the specified level. By suitable circuitry the signal can be recorded and/or made to operate marking devices or kick-off mechanisms on the conveyor belt.

Linear accelerators present a more difficult monitoring problem because the energy of the electrons cannot be measured directly. The pulses of electrons are accelerated by a radio frequency travelling wave and the electron energy is affected by field strength and frequency of the r-f wave. The peak frequency is affected by various factors such as changes in line voltage, drift in phase, defocussing, etc. Any change in the energy of the r-f wave affects penetration, scan width and dose. Thus more factors must be checked to ensure satisfactory operation.

In fact the accelerating voltage measured in the case of the Van de

Graaff is replaced by a frequency parameter. The scan width can be measured by placing two metal absorbers at each end of the scan, some $\frac{1}{4}$ in. apart. The two outer absorbers and the two inner ones are wired to separate ammeters. In operation the inner pair of detectors should be touched by the beam and the outer ones not. Thus if the scan widens both sets of absorbers record current and if the scan narrows neither ammeter records.

A meter on the exit window of the waveguide tube records the electron current by monitoring the amount of energy absorbed by the window; in general the more current absorbed in the window the lower the energy of the electron beam.

Experience showed that to prevent trouble it was important to monitor many parameters including focus-coil currents, operating and pulse frequencies, vacuum, r-f power, line voltage, power supply voltage and accelerator room radiation level.

Conveyor speed must be controlled accurately at the point of irradiation and normally a speed of 15-18 in. per min. is used and monitored continuously. For maximum beam utilisation the conveyor system was designed so that there are no spaces or gaps in the flow of material.

Linac operation

The only way of measuring the particles' energy is to absorb the beam completely in a stack of dosimeter slides—sheets of material such as photographic emulsion that change measurably according to the amount of radiation received. From the measurements of the slides after exposure the useful penetration is calculated and then converted into electron energy. (An energy of 1 M.e.v. implies a penetration of 0.130 in. in material of unit density.) By plotting dosimeter plate readings against position in the stack, an ionisation distribution curve is obtained.

At first the uniformity of scan of the linac beam was unsatisfactory. Within a scan of 14 in., the dose varied by 1.0 to 1.2 megarads around a nominal dose figure of 2.5 megarads. By adjusting the pole-pieces of the scanning magnets this latitude was cut to 0.5-0.7 megarad—still greater than the scan given by the Van de Graaff machine but good enough for sterilisation as long as the average dose was right.

Another problem found was a fluctuation of beam energy during a run. While initially there were some large and many small fluctuations it was found that the large ones could be eliminated by keeping the machine adjusted to optimum operating settings. The small fluctuations still occur but they do not affect the processing to any extent. On occasions when the energy of the machine was found to be dropping off despite correct adjustment of the linac it was possible to anticipate major component failure through the dosimetry.

It took some six months to get efficient and consistent operation from the linear accelerator.

Process monitoring

Dosimetry is the key to process monitoring. Various types of dosimetry plates were adopted: ceric-cerous plates as primary standards with blue cellophane and rigid vinyl film plates as secondary standards. The rigid vinyl film is suitable for the measurement of total and useful penetration, ionisation distribution, scan width and uniformity.

At the start of each shift a production tray is put through the system containing 14 rigid vinyl slides in a row, at right angles to the direction of travel, and a stack of 60 slides to absorb the beam completely. The slides measuring 3 in. by 1 in. by 0.15 in. thick are placed on $\frac{3}{4}$ in. thick plywood to reduce backscatter.

After passing through the system the slides are developed and read. The 14 slides across the tray indicate if the scan width is satisfactory to cover the product, the dose is right and the dose is acceptably uniform across the scan width. From the stack of 60 slides the depth of useful penetration is determined.

As a spot check for dose, a single slide on a plywood backing in the centre of a tray is sent through the system every hour. The same procedure is used to check the Van de Graaff machine.

Product monitoring

For an even closer check on the processing, a rigid vinyl slide is placed under the product on each tray. The slides are marked so that they can be identified and related to the tray of product. After passing through the system the slides are developed and read—only

if they have received a sterilising dose is the tray released for the next stage of sterility sampling. Otherwise the material in the tray is reprocessed.

Package design

Radiation sterilised sutures are packed in aluminium foil, a design adopted after a great deal of investigation into aluminium foil-plastic laminates. The package is impermeable, attractive in design takes irradiation well and is easily opened by tearing. An apparent disadvantage is that it is opaque, but field evaluations indicate that there is no preference for a transparent package—the most important factors required are ease of opening and good identification markings.

The first ideas on packaging were to find a plastic transparent like the glass tubes. The irradiation characteristics of a large number of plastic films were determined together with their permeabilities. Not only must the pack stand up to irradiation, it must be impermeable to the fluids inside the pack, *i.e.* 90% isopropyl alcohol to make the catgut pliable. In addition, because the packages are stored in a solution of 97% isopropyl alcohol and 1% formaldehyde to produce and maintain sterility on the outside of the package, the pack must be impermeable in the other direction. Any significant penetration of formaldehyde into the pack would destroy the catgut. The only plastic film to meet the requirements was found to be too expensive.

What does it cost?

While it is difficult to adjust cost figures from one irradiation operation to another, the essential cost factors can be given and some estimates made.

Capital costs are high. The accelerators range from about \$50,000 to nearly \$200,000, depending primarily on the power output. Monitoring and control equipment can range from as low as \$5,000 to as high as \$75,000. Finally the cost of the building will depend on the type of construction and the space needed—both factors dependent on the machine chosen. For example a 3 M.e.v. Van de Graaff machine needs a minimum of 20 by 25 ft. area with at least 30 ft. headroom. A modern linac requires much less space particularly in headroom.

Principal operating expenses are

(Concluded on page 452)

How to Avoid Accidents in a Fine Chemicals Factory

By Stanley Price*

Automatic control and remote handling can eliminate most chemical accidents, but in the fine chemicals industry many chemicals, often highly toxic ones, are made in such small quantities that batch processing and manual handling are unavoidable. It is essential, therefore, to pay the utmost attention to the human factor. The policy of building safety into plants and processes must be supplemented by careful training of operatives and the strictest supervision of detail.

PEOPLE outside the fine chemicals industry are apt to suppose that because of the materials used it must be a dangerous industry. This is not true. Without doubt there are many chemicals which are highly dangerous if allowed to get out of control, but if normal care and foresight are exercised there is little likelihood of accidents being more frequent than in any other industry. As a whole the chemical industry has a very good record for the infrequency of accidents due to chemicals. Most accidents in the industry are the same as those that occur in other industries—i.e. falls of persons, handling objects, etc.

The manufacture of fine chemicals for the pharmaceutical industry can be divided into three main classes:

- i. extraction of drugs of vegetable origin,
- ii. extraction of animal glands,
- iii. synthetic products.

In addition to the hazards common to all, each has its own particular safety problems. Before dealing with the special measures associated with these three types of processes let us consider those common to the whole.

Common chemical hazards

Chemical hazards naturally fall into two broad divisions—namely, dangers due to chemical action of the substances on the body tissues or the materials of construction, and danger of fire or explosion. The first and most important safety measure is to design the plant and the process with the aim of using chemicals of the least possible toxicity.

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If it were possible to totally enclose all plants and to use materials of low toxicity and in addition move them by mechanical means through all stages of the process most safety problems would disappear.

Unfortunately, in this industry a large number of products are made in infinitely small amounts by batch processes and to install specialised plant for each and every process is impracticable, both for reasons of cost and space. Plant is therefore of a general purpose type and its design must include safety devices for the many and varied uses which will be made of it. Secondly, batch work must at some stage involve the manual handling of materials. Supplies of raw materials are rarely packed in the exact quantity required for each batch and therefore have to be weighed or measured. The different types of intermediates produced from any one vessel make it impracticable to provide mechanical handling for each one, and finally the finished product as well as the intermediates may be highly toxic. In these circumstances the employee is subject to risks of exposure, but careful planning of plant in the design stage can reduce manual handling of toxic chemicals to a minimum. It is even better to substitute a material of low toxicity even if it means adding an additional stage to the process. Quite often the deciding factor in design is the quantity of material used and unless the process is examined in its early stages it can result in the plant being designed to handle mechanically large quantities of harmless chemicals, leaving small quantities of dangerous toxic materials to be manhandled. If there is only one connection left on

a vessel and there are two more substances to add—100 gal. of water and 10 litres of a highly toxic substance—it surprises some people if it is insisted that the connection be used for the toxic substance, leaving the water to be handled manually. This is simply because traditionally water is always piped.

There should be close liaison between the Safety Department and those responsible for design and development. It is cheaper to include safety features in the design stage than to add them after the plant is installed and, incidentally, quite often impairing the efficiency of the safety features and the operation of the plant itself.

It is of the utmost importance to train the operator carefully. He should never be left to discover hazards by exposure to them or be put with an older man who may have bad habits left over from past years when safety precautions were disregarded, especially when handling small quantities of corrosive substances. He should be given a proper training course to teach him as much as possible about the hazards of the chemicals he will use. He should also be made aware of all types of protective clothing and other equipment available for his use and which type to use for each particular hazard. At the conclusion of the training the operator should be set a simple test to make sure he has absorbed enough to allow him to work under supervision.

Another important safety measure is the use of process or instruction sheets which contain details of the process and of all the precautions to be taken, including the protective clothing or equipment to be used. All safety instructions should be fully detailed. It is not enough for

the instruction sheets to say "use goggles, gloves, etc." The reason for their use should be given. Fig. 1 is an example of what a process sheet should contain. It has been compiled for part of an imaginary process, and is given purely as an illustration.

The plant to be used is checked by the chemist in charge for chemical cleanliness and the instruction sheet is then handed to the operator.

All the hazards mentioned in the instruction sheet could be avoided by use of relatively simple automatic procedures, e.g. automatic temperature control, automatic addition of reagents and automatic weighing, if only manufacture were on a large enough scale for X20 to be used for the one process. As it has to be used for several this is not possible.

These then are the main problems connected with the whole; let us now look at special measures required for the three types of processes.

Extraction of animal glands

The hazards associated with processes of this type are relatively simple. The materials used generally consist of animal glands, solvents and small amounts of other generally harmless chemicals. Therefore, toxicity is low. The greatest risk is fire or explosion, and this risk is often reduced when the solvents used are diluted.

In these types of processes it is advisable for all equipment to be flameproof and for adequate ventilation to be provided. A small amount of protective clothing, such as goggles or face visors and gloves for handling small amounts of corrosive substances, should be issued. Barrier creams or hand creams should be used to counteract dryness of skin caused by contact with the solvents or solvent vapours.

It may be necessary when handling the drug in its dry pure state to use a dust respirator, as quite often these drugs irritate the nasal membranes.

Extraction of drugs from vegetable matter

These processes give rise to a number of hazards, the principal ones being the risk of explosions from dusts, fire, the high toxicity of the drugs and in some cases powerful irritants.

INSTRUCTION SHEET

Process for Nitroxythilium.

Plant to be used: Vessels X19 X20 X21 and X22.

Check exhaust ventilating system, vacuum and compressed air.

NOTE: It is important to check these services to ensure that they are effective.

Protective Clothing required: Compressed air mask, full face P.V.C., gauntlet gloves, P.V.C. apron and rubber boots, goggles or face visor.

Materials required:	Aluminium chloride	...	...	250 lb.
	Acetic anhydride	...	...	40 lb.
	Toluene	...	...	60 gal.
	Hydrochloric acid	...	...	60 gal.
	Caustic soda flake	...	...	250 lb.

Procedure: Dissolve 250 lb. caustic soda in 200 gals of water.

NOTE: Caustic soda is a strong corrosive alkali. USE GOGGLES AND GLOVES.

Using vacuum suck the caustic soda solution into vessel X19. Add 60 gal. of toluene to caustic soda solution in X19 using vacuum. Switch on stirrer, and by means of jacket steam raise the temperature to boiling point and allow to reflux for 1 hr. Cool the plant by means of the jacket water to a temperature of 20°C. and charge 250 lb. aluminium chloride into the plant via the manhole cover at a slow rate.

NOTE: Aluminium chloride reacts violently with water and each reaction must be allowed to die out before more is added. GOGGLES AND GLOVES MUST BE USED.

Using the steam water mixture heat the contents to a temperature of 30°C. to 40°C. and stir within this temperature range for 1 hr.

Meanwhile charge the header tank on Plant X20 with 40 lb. acetic anhydride. Weigh by sucking directly from carboys, using mobile scales.

NOTE: Acetic anhydride is a strong corrosive acid, and lachrymatory. WEAR GAS-TIGHT GOGGLES, RUBBER APRON, BOOTS AND GLOVES.

Cool the mixture in Plant X19 and allow contents to separate. Suck off into Plant X20 by means of vacuum the toluene and aluminium mixture leaving the caustic soda mixture behind in Plant X19. Stir the mixture in Plant X20 for 1 hr. and commence to add the acetic anhydride at the rate of 2 gal per hr., maintaining the temperature of the mixture at 40°C. to 45°C., and stir for 1 hr. after the acetic anhydride addition is completed. Meanwhile flush out header tank with water allowing the washing to run to waste. When clean suck into header tank 60-gal. hydrochloric acid direct from carboys.

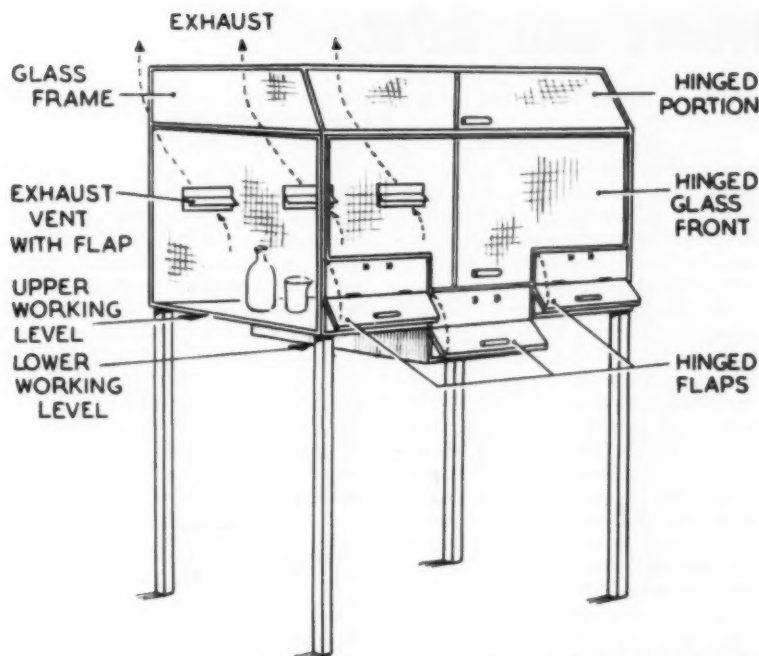
NOTE: Hydrochloric acid is corrosive. WEAR GOGGLES AND GLOVES.

Fig. 1.

Much has been written about the technical differences of fires and explosions and their causes, and therefore it is only necessary to say that under certain conditions most chemicals can be made to ignite and burn. As most of the vegetable matter used in these processes has to be ground in a dry state and can easily be ignited, there is always a risk of dust explosions. The grinding mill, cyclone chamber and hopper should be separately enclosed in solid brick walls and iron doors. Each room should be fitted with explosion reliefs, large enough to absorb the main pressure, and the walls and doors should be strong enough to withstand the initial shock. The doors should also be electrically interlocked with a time delay sufficient to prevent them from being opened until the machinery is stationary. All material to be ground should be fed to the mill on a conveyor passing over a magnetic field, to remove any foreign metal, and constant watch should be kept for any other

substances, such as flints or stones, which are not removed by the magnetic field.

The grinding mill itself should be made from sparkproof metal, and all electrical equipment should be flameproof. No reliance should be placed on the claim that the amount of air passed through a grinding plant is such that the mixture is below the inflammable limits. In any case the concentration will vary with the rate of feed, and therefore at times the dust must pass into the inflammable range. Special attention must be paid to the escape of dust into the workroom, and on no account should the dust be allowed to collect in quantity, as quite often the most disastrous explosions are not the explosions in the plant itself but those occurring when the accumulated dust is blown into a fine cloud and ignited by the original explosion. All workrooms should be kept clean and free from dust, fitted with exhaust systems and well ventilated. Operators should be provided with compressed air masks or



FRONT FLAPS ARE ONLY USED SINGLY WITH CORRESPONDING VENT FLAP.
FRONT AND TOP OF CABINET ARE HINGED FOR CLEANING PURPOSES.

An exhaust cabinet for processes giving rise to toxic dusts.

dust respirators and goggles. Leather or cotton gloves often provide adequate protection for operators handling the unground material. As the solvents used in the processes are many and varied, and highly inflammable solvents are often used in large quantities, precautions against fire must be thorough and extensive. In addition to flame-proof electrical equipment, sources of static electricity and the danger of sparks from tools, footwear, etc., must be eliminated. Other solvents, although not so inflammable, may be toxic and should if possible be used in closed vessels with exhaust systems and ventilations. If solvents are used or stored in open vessels an effective exhaust system can be installed by connection from an extraction fan through wide-bore flexible tubing to suitable openings made in the loose lids covering the pans.

As the pure drugs in this range are often very potent, highly toxic, and in some cases powerful irritants, extreme care must always be exercised when the pure drug is in its dry state. Whenever possible work should be done in enclosed exhausted cabinets with a safety

procedure rigidly adhered to when work is in progress and particularly for cleaning cabinets and equipment after use. When it is not possible to use an enclosed exhaust cabinet, protective clothing should be provided which may range from full protective clothing to a simple dust respirator. But whatever clothing is used a procedure for cleaning and washing must be laid down and kept.

Synthetics

The increasing range of new synthetics has brought into use many combinations of chemicals, many with unknown hazards. The dangers of these new substances lies not in the immediate effects they have, as these can be summarily dealt with, but with the danger of long exposures to small amounts of the substances, the ill effects of which are not immediately noticed. It is essential that until the hazards of new products are fully known they should be treated as dangerous and the fullest possible protection should be provided against exposure, even in small quantities. Because of the many and varied combinations of chemicals used in

this type of chemical manufacture the number of hazards are greater, due to the number of instances in which the process depends on the reaction of the chemicals used. Quite often the reaction may be violent. Serious consideration must therefore be given to the design of the plant and the arrangement of the process (see "Processes involving special hazards" by T. Dewing, M.Sc., Ph.D., F.R.I.C., MANUFACTURING CHEMIST, October 1954, pp. 423-7).

The known hazards in this type of manufacture can be classified as corrosive, irritant, toxic, fire and explosions.

Precautions against fire can be taken by eliminating all sources of ignition and against explosion by providing vessels with explosion releases, either safety valves or bursting discs vented to the outside atmosphere. Full protective clothing should be provided for operators handling corrosive and irritant substances. Where toxic substances are used or toxic vapours are evolved, in addition to the provision of exhaust systems and good ventilation, some form of breathing apparatus should be included with the protective clothing for emergency use. Where possible the use of an air pressure mask is preferred, as it has certain advantages over the canister type of respirator.

Pharmaceutical processing

The safety problems associated with pharmaceutical processes in which the pure drug is converted into the form in which it is presented to the public do not in the main present many difficulties. The greatest hazard is generally the handling of quantities of the pure drug in its dry state, but as the toxic properties are usually well known appropriate action can be taken. Highly toxic drugs should be confined in enclosed cabinets fitted with exhaust systems and other drugs may only need efficient dust extraction plant. In all stages where the drug has any marked degree of toxicity, protective equipment should be used as a second line of defence.

As with chemical manufacturing processes, the pharmaceutical processing should include detailed safety instructions.

Although the use of protective clothing is considered an admission

(Continued overleaf)

Solvents and Safety

AT THE beginning of the century many solvents used in industry were inflammable as well as toxic, and their use in congested factories and workshops was highly dangerous and sometimes fatal. Nowadays there are not only better products but better regulations to secure safe and healthy working conditions. However, nearly every solvent has properties that require attention from a safety point of view.

Chlorinated hydrocarbon solvents manufactured by I.C.I. on a large scale, were developed mainly because they are safer—non-inflammable—and because they also possess very powerful solvent properties for rubber, many oils, fats, waxes, resins and plastics. They have low surface tension which enables them to penetrate materials and act quickly. In many solvent plants there are arrangements for distilling so that the solvent can be recovered and re-used, a factor that allows low running costs. The most important chlorinated hydrocarbon solvents are trichloroethylene ($\text{CHCl}_2\text{CCl}_3$), perchloroethylene ($\text{CCl}_2=\text{CCl}_2$), methylene chloride (CH_2Cl_2) and chloroform (CHCl_3).

Even though they are non-inflammable they are not without various properties that demand respect in handling. They have anaesthetic properties (as everyone immediately associates with chloroform); except for chloroform the above-mentioned solvents have "acute" toxicity (i.e. there are no after effects when the subject has recovered). Chloroform itself has "chronic" toxicity (i.e. is able to produce cumulative physiological changes in people who are repeatedly exposed to its vapour even in such low concentrations that no immediate or acute effects are experienced).

Another point is that the vapour of these solvents is heavier than air and would therefore collect in pits, cellars and similar places where there is not adequate low-level ventilation.

The solvent vapour must not be exposed to naked flames or red-hot surfaces since it can form acidic gases.

Care must be taken to prevent skin contact with these solvents since they will remove the natural grease; special creams are available, if

necessary, for replacing the natural grease.

It is quite obvious that these solvents must be handled correctly, but, with a little care and forethought in selection of the safest and best solvent for the job, selection and siting of plant and training of operators, no trouble need arise.

In the Factories Act of 1937 there are sections that are particularly relevant to solvents; for example, there must be adequate ventilation to remove fume (Section 47), and people must not enter places where fume is likely to collect without wearing the correct breathing apparatus and safety line, etc. (Section 27). The use of trichloroethylene as a rubber solvent is covered by the Indian Rubber Regulations, 1922.

In the metal degreasing field I.C.I. provides not only the solvent, trichloroethylene, but the plants in which it is used. Here again, in the design of plant, great care is taken to prevent risk to the operator; solenoid-operated stop valves, thermostats, rim ventilation and simple float devices are used where appropriate to make quite sure that the plant is safe, even in the event of a breakdown. This is the case, too, with drying plants for use with *Trisec* metal drying assistant, a recently-launched product, which is used as an additive to trichloroethylene for drying metal after aqueous processes and leaving it completely stain free.

Manufacturers of dry-cleaning plants, many of which are used with perchloroethylene, also pay great attention to safety, and the dry-cleaner is rewarded by being able to erect an enclosed perchloroethylene plant in his shop in busy built-up areas. This eliminates the need to carry work out by van to a more remote plant and gives quicker service to customers.

Considerable quantities of perchloroethylene and trichloroethylene are used in the extraction of animal and vegetable oils and fats. Extraction plants are of the totally enclosed type so that there are both good working conditions and low solvent losses.

Methylene chloride, used in the manufacture of cellulose acetate and cellulose triacetate, is also worked in fully enclosed plants.

Although less toxic than the other solvents mentioned it is considerably more volatile.

I.C.I. is most careful to follow up enquiries for solvents to see whether the best solvent is being supplied for the job, and to ensure that the customer handles it safely. Technical assistance is always available on request. There are leaflets on the various products and on technical matters such as the erection of bulk storage installations. There are also wall cards listing precautions to be observed and first aid or medical instructions, which are issued to be hung up where the solvent is used.

HOW TO AVOID ACCIDENTS IN A FINE CHEMICALS FACTORY

(Continued from page 443)

of failure to provide a better system, its use under certain circumstances is unavoidable. Protective clothing ranges from complete suits of impermeable material under pressure to the simple face visor or gloves. Consideration should be given to the redesigning of any process which involves the use of full protective clothing for long periods. It is important to use the right type of protective clothing or equipment for the particular job and to make sure it is comfortable to use. Many operatives regard the wearing of protective clothing as a nuisance and therefore supervision must be such as to prevent anyone trying to avoid using it. No one, irrespective of status or time, should be allowed to enter any plant or approach any part of a process which requires the use of protective clothing unless they are wearing the prescribed clothing.

Processes and safety procedures should be constantly examined and revised to keep pace with the many new chemicals now being used. There is also a considerable and expanding literature available on the hazards and effects of various chemicals which should be studied by all concerned with safety. Much helpful advice and information can be obtained from the Association of British Chemical Manufacturers, the Royal Society for the Prevention of Accidents Industrial Division, and the Institute of Industrial Safety Officers.

Safety Equipment Review

Explosion prevention

The idea of an explosion relief panel consisting of a sheet of material such as polythene is not new, and several types in service incorporate a cutting mechanism to assist the rupture of the panel. Most of these panels have been made up by different companies for their own use and have not been tested or proved in practice. Gravinier Manufacturing Co. Ltd. have now evolved a proved design which is practically equivalent to an open vent. It consists of a sheet of polythene, the rupture of which is assisted by two adjustable external cutting knives. This type of rupture panel is very suitable where a large vent area is required and the operating pressure is about atmospheric and the temperature approximately ambient.

For high temperature applications a ball catch relief valve has been developed. The valve is held in the closed position by the pressure exerted from the ball catch mechanisms. At a predetermined pressure the balls are ejected and the valve, being completely free, opens very rapidly. This valve also meets certain requirements where after venting it is necessary to prevent the ingress of air into the plant.

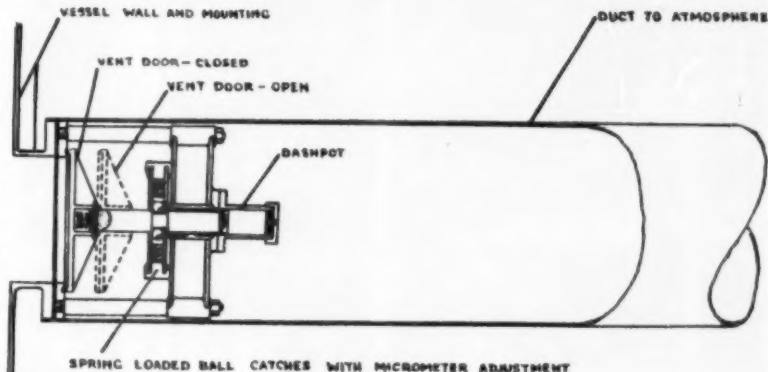
Delanium graphite bursting discs, manufactured by Powell Duffryn Carbon Products Ltd., are available in a standard range from 5 p.s.i.g. to 75 p.s.i.g. and are supplied complete with gaskets. The bursting pressure and the "vent side" position is printed on the gasket tabs and a uniform design of holder is supplied to accept discs of all standard pressure ratings. Outside diameter of the carbon holder is designed to fit within the bolts on B.S. or A.S.A. flanges.

Vacuum support devices are required with the discs when the bursting pressure is below 20 p.s.i.g. and negative pressure is likely to occur during plant operation. For discs bursting at between 10 to 20 p.s.i.g. a graphite bar support is used, and for those bursting between 5 to 9 p.s.i.g. a dial type support is required.

Flameproof heating

Heating mantles made by Isopad Ltd. are available in a special version, the FPM, suitable for use in flameproof areas.

In this the heating elements are mineral insulated and metal sheathed and terminate in flameproof glands and junction boxes. The element sheath is earthed through the junction box, so that no sparking or short circuit is possible, even in the event of spillage. The surface temperature of the heating element must be kept below the ignition temperature of the vapours or gases present, and this can



Ball catch type explosion relief valve by Gravinier Manufacturing Co. Ltd. At a predetermined pressure the balls are ejected and the valve opens rapidly.

be achieved by choosing the correct wattage to keep below maximum temperature. A full range of manual and automatic controls is available for that purpose.

Flameproof *Isomantles* are also available for laboratory size flasks, and, at the other end of the scale, for process vessels of any capacity.

Fire extinguishers

The new 16-floor skyscraper in Basle, Switzerland, built and occupied by Geigy, has been equipped with Nu-Swift extinguishers.

Old-fashioned chemical extinguishers in the Shell-Mex Building, in the Strand, London, largest office building in the Commonwealth, have been superseded by Nu-Swift equipment. Built in 1933, the 8,008,462 cu. ft. of this giant edifice, which boasts 16 lifts, 6 oil-fired boilers and 22 miles of water pipes, are now protected by 261 Nu-Swift extinguishers.

Non-slip flooring

Gripdec, made by Semtex Ltd., is a slip-resistant, anti-corrosive, water-proof, protective floor coating based on a blend of chemical, rubber and resinous compounds and a non-slip mineral filler.

It is stated to have a tenacious bond to steel, timber or any firm adherent surface and to retain sufficient flexibility to withstand a certain amount of movement without becoming detached. It is unaffected by solvents, grease and oil, is dimensionally stable and does not deteriorate as a result of rapid changes of temperature. Three colours are available, terra-cotta, forest green and buff.

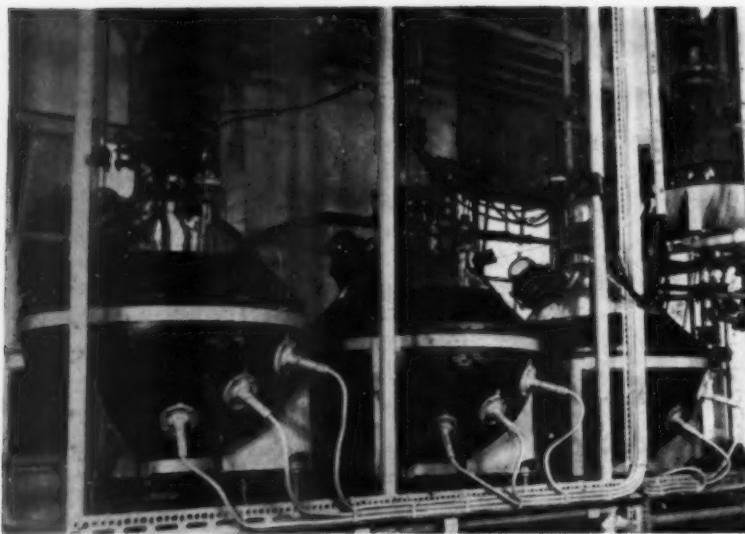
Gripdec is supplied in the form of a coloured, heavy paste and white liquid accelerator in unit containers of 50 lb. and 25 lb. Since it is recommended that two coats be applied at the rate of 1½ lb. per sq. yd. each coat, the coverage, after mixing with accelerator and spreading, is 16 sq. yd. and 8 sq. yd. respectively. To obtain this average each coat must be spread as thinly as possible.

Breathing apparatus

Siebe, Gorman and Co. Ltd. have developed new types of breathing apparatus with improved safety features and added comfort and simplicity. One of these is a light-weight ½ hr. oxygen breathing apparatus weighing 12½ lb. complete with mask. It is contained in a fibreglass case supported by *Terylene* webbing.

The improved Mk. IV self-contained compressed air apparatus is fitted with a wide vision face mask and provision has been made for the quick attachment of a second mask, enabling two men to breathe from the one cylinder on the set. For rescue work or inspection in gaseous atmospheres its advantages are apparent.

The latest addition to the company's range of dust respirators, the Mk. VIII, is said to be capable of giving protection against dust down to ½ µ particle size. The respirator has a soft rubber face-piece with an inner flange to ensure a dust-tight fit on all shapes of face. The sealed filter cartridge cannot be tampered with and is easily replaceable; a cotton-wool prefilter is fitted. The respirator is supplied in two sizes, small and medium, and weighs 5½ oz.



Flameproof isomantles used for heating 100 litre flasks.

Flameproof switches

K.D.G. Instruments Ltd. manufacture a range of flameproof pressure and differential pressure switches. The instruments are designed to meet the requirements of BSS. 229 and are fully approved by the Ministry of Fuel and Power for Groups 1, 2 and 3 gases and carry Buxton Certificate No. FLP. 3669 and 4081. Pressures from absolute to 5,000 p.s.i. can be accommodated. A recent addition to the range is a diaphragm-operated flameproof unit of stainless steel construction, provided with a calibrated scale and suitable for external adjustment. It can be fitted with various sized inlet connections and is said to be suitable for viscous liquids. Pressure ranges are from 0-20 p.s.i. to a maximum of 300 p.s.i.

The company also supply a flameproof differential pressure switch for a range of 0-30 in. w.g. up to a max. of 20 p.s.i. to suit static pressures of 150 p.s.i. Another pressure switch, the SP-1016, is an air purge failure switch for the protection of electrical equipment operating in hazardous atmospheres. It has a pair of contacts arranged to cut off supply to all electrics on failure of air flow. In addition to the contacts, the unit is fitted with a pressure gauge indicating air pressure in the system, and a vent valve. The standard range is 18 in. w.g.

Liquid level switches are also available for alarm and/or control. They have adjustable contacts for 1, 2 or 3 level operation.

Protective clothing

Neoprene gloves are available from Lewis Gilder and Co. Ltd. Among advantages claimed for them are lighter weight than conventional gloves

and a more satisfactory working surface.

Siebe, Gorman and Co. Ltd. manufacture a range of protective clothing which covers most of the needs of the chemical industry. Garments are tailored to give comfort in use and long life. Various materials are available, but the standard range is made in two qualities of p.v.c.-coated rayon or Terylene.

The resistance of nylon to alkalis and its exceptional durability have made it increasingly popular for industrial clothing. Where heavy splashing is encountered, however, there has been some seepage through the weave on to the wearer's clothing. This has now been overcome by a new method of proofing which not only increases nylon's alkali resistance, but also makes it impervious to liquids, even under pressure.

The new proofing has also been applied to terylene.

The manufacturers, Heafield Industries Ltd., say that unlike plastic-coated fabric, the new proofed nylon

and terylene is ventilated for healthy and comfortable wear.

Safety ladders

A new form of safety ladder which is extensible and can be folded up compactly when not in use is manufactured by Tubewrights Ltd. Each rung is open on one side, to allow the user to get on or off the ladder at any level.

The ladders are 2 ft. square in plan. The rungs, made of galvanised tubular steel and 1 ft. apart, are supported at the corners by flexible steel wire ropes attached to eyelets threaded over the rungs, each section being attached to the next by small shackles. The standard ladder is 20 ft. long, closing to 16 in., and weighs 1 cwt.

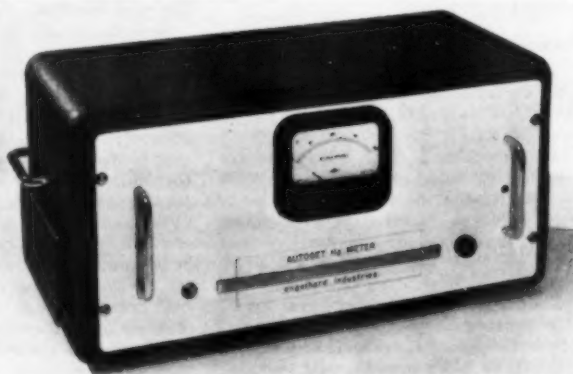
Boiler control equipment

Control equipment made by George Kent Ltd. has been successfully applied to cyclone-fired boilers for the control of steam pressure and temperature, drum level, furnace pressure and combustion. The company's Mk. III *Multitec* electronic strip-chart oxygen recorder has a high-speed response and is claimed to give a true picture of flue gas composition. The instrument can also be used for direct control of combustion with a controlling unit from the Mk. 30 range. These instruments combine high response speed with the advantages of pneumatic equipment.

Kent Mk. IV power cylinders and positioners can be used with Mk. 30 controlling units for plant control. Cylinder sizes range from 3 in. bore \times 6 in. stroke to 10 in. bore \times 36 in. stroke.

The Kent Lockheed system provides for standby regulation in the event of failure of the compressed air supply to pneumatic control systems. It comprises a Lockheed hydraulic cylinder acting in parallel with a Kent pneumatic cylinder. In the event of a failure the hydraulic cylinder locks the plant regulator in its prevailing position, allowing manual operation from hydraulic selectors on the boiler panel.

Autoset mercury vapour meter by Engelhard Industries Ltd.



Detecting toxic vapours

Mercury poisoning in varying degrees arising from the regular assimilation of Hg vapour in air is now recognised as an industrial hazard. A new meter from Englehard Industries Ltd. offers the following advantages: operation on a wide range of supply voltages without adjustment; operation independent of changes in line voltage; alarm and/or control circuit facilities available; the instrument may be directly connected to a low pressure closed circuit; preset controls and no zero adjustment required by the user.

Two ranges, 0-100 and 0-600 μ grams Hg/m³ of air or other non-U.V. absorbing gaseous medium, meet most industrial requirements. An *Autoset* device can be used to sound an alarm or to operate a control mechanism if the Hg vapour content exceeds a preset level.

An aspirator pump is available as an auxiliary unit if required. A potentiometric recorder can be coupled to the meter.

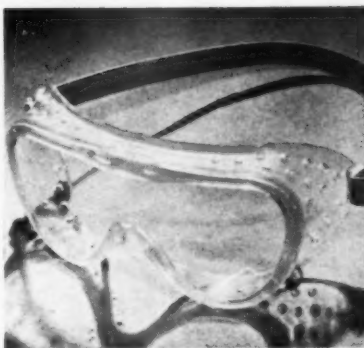
A benzole meter, made by the company, primarily designed to measure the benzole content of coal gas, has recently been made more sensitive, giving full-scale deflection for 10 g. of benzole per m³ of non-U.V. absorbing gaseous medium.

Fume absorption

A compact, self-contained fume absorption unit to deal with noxious or offensive gases, as required by the Alkali Act and the Clean Air Act, has been designed by Hathernware Ltd.

The plant consists of an absorption tower, ejector, pump and liquor tank. The stoneware tower is supported above the tank and is arranged with the bottom immersed in the liquor forming a seal. A liquid-operated swirl-type stoneware ejector draws the fumes up the tower. This type of ejector is said to be capable of moving a good quantity of gas against a small back pressure. The stoneware pump actuates the ejector and re-circulates liquor in the tower. Liquor from the tank is all returned either down the tower or from the tail pipe of the ejector, and can be checked to maintain its efficiency for absorbing the fume. When spent, the liquor can be drained off after neutralising to the required degree.

The tower, ejector, piping and valves are treated externally with resin-bonded glass fibre. This method of armouring, known under the trade name *Fibresin*, protects the stoneware from mechanical and heat shock. The tower, of square section 18 in. inside, has a distributor in the top, supplied with liquor from the pump, the liquor falling on to grids of stoneware bars, ensuring a continuous "rain" down the tower. This form of tower is stated to give a low-pressure drop which is essential for operation by the swirl-type



Lightweight, all-plastic goggles by Safety Products Ltd., who claim that they are highly resistant to chemicals.

ejector. The liquor tank is of mild steel, lined with stoneware tiles, supports for the tower and ejector being of fabricated steelwork.

The absorption unit, which is available in three sizes handling 52, 77 or 104 c.f.m., is capable of modification in different ways to meet clients' needs and site conditions. Increased quantities can be handled by using two ejectors in parallel.



Different types of neoprene gloves available from Lewis Gilder and Co. Ltd.

Packaging know-how. An illustrated booklet from John Dale Ltd. gives a short survey of the activities of the company's Packaging Division. Data given cover collapsible metal tubes, nozzles, caps and internal coatings; urea and phenolic moulded closures; and polythene, polystyrene and cellulose acetate mouldings for the packaging industry. Aerosol and rigid containers for pharmaceuticals are also mentioned.

Technical Press Review—November

Chemical and Process Engineering.—Drying; Particle Size Analysis; Prepared Atmospheres in the Chemical Industry; Design of a Packed Batch Distillation Column; Norway's Halden Reactor; Progress at the Bradwell Nuclear Power Station; Chinese Progress in Nuclear Science.

Corrosion Technology.—Electrical Installations in Corrosive Environments; The Permanent Anode in Impressed-Current Cathodic Protection Systems—2; Zinc Coatings Prevent Corrosion Fatigue; Air Treatment to Prevent Corrosion of Stored Goods—2; Corrosion in Processing Russian Petroleum.

Automation Progress.—Automatic Testing and Sorting of Welded Tube; Transistor Mag-Amp. Arrangement for High-speed Servo Drive; German View of the Economics of Automation; Remotely Controlled Machining of Radioactive Graphite; Magnetic Amplifiers as Speed Control Elements.

Petroleum.—Whitegate Refinery; Ireland's First; French Saharan Developments; Refinery Expansion in Europe; Ravenna Petrochemical Plant; Gas-Solids Contacting in Fluidised Beds; Oilfield Development—5; Production Methods.

Paint Manufacture.—Shapes and Properties of Polymer Molecules; Rafalite; Anticorrosive Properties of Red Lead Pigments; Aluminium Complexes in Paints—2.

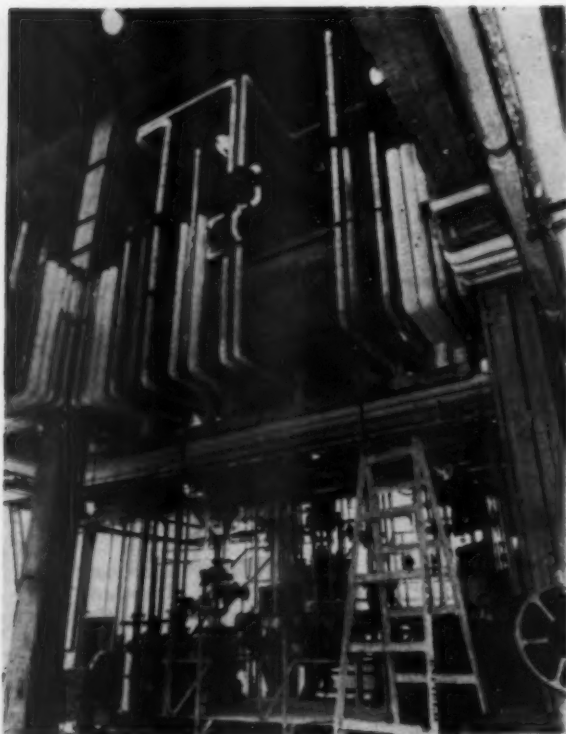
Fibres and Plastics.—Cyanoethylation for Better Cottons; Air Filtration; Dust Collecting and Conveying; Ventilation and the Textile Industry; Air Treatment and Control; Computers and the Textile Industry.

Food Manufacture.—Sugar Confectionery Machinery; Crab Canning Industry of British Columbia; The South Wales Laverbread Industry; Spray-dried Foods.

Dairy Engineering.—Sterilised Milk; End Process Heating in Bottles; The Microscope for Dairy Chemists; Aseptic Canning of Dairy Products; Laboratory Equipment and Furnishings Review.

World Crops.—Fifty Years of Aerial Farming; Plant Nematodes; Crop Protection by Seed Treatment.

For specimen copies and subscription forms apply to the Circulation Manager, Leonard Hill House, Eden Street, London, N.W.1.



Left: A view up the well of the new building showing the centrifuges and extractors on the ground floor and the mass of pipework connecting these units with the reactors on the first floor. Right: The four reactors on the first floor with the three charge tanks above.

Flexible Organic Chemicals Plant

THOMAS MORSON'S NEW UNIT AT PONDERS END

A compact, flexible plant for the manufacture of a wide range of organic chemicals has recently been brought into operation by Thomas Morson and Son Ltd., at their Ponders End, Middlesex, factory. The plant is the first step in a modernisation and expansion programme made possible by the amalgamation of this old-established firm with the American Merck Sharp and Dohme organisation.

THE quickly changing needs of fine chemical manufacture combined with the long delivery and high cost of chemical plant pose acute economic and technical problems. It is in an attempt to overcome these difficulties that the General Organics Unit at Ponders End has been built. The unit has been designed to carry out the standard reactions in the manufacture of organic chemicals and the keynote is flexibility.

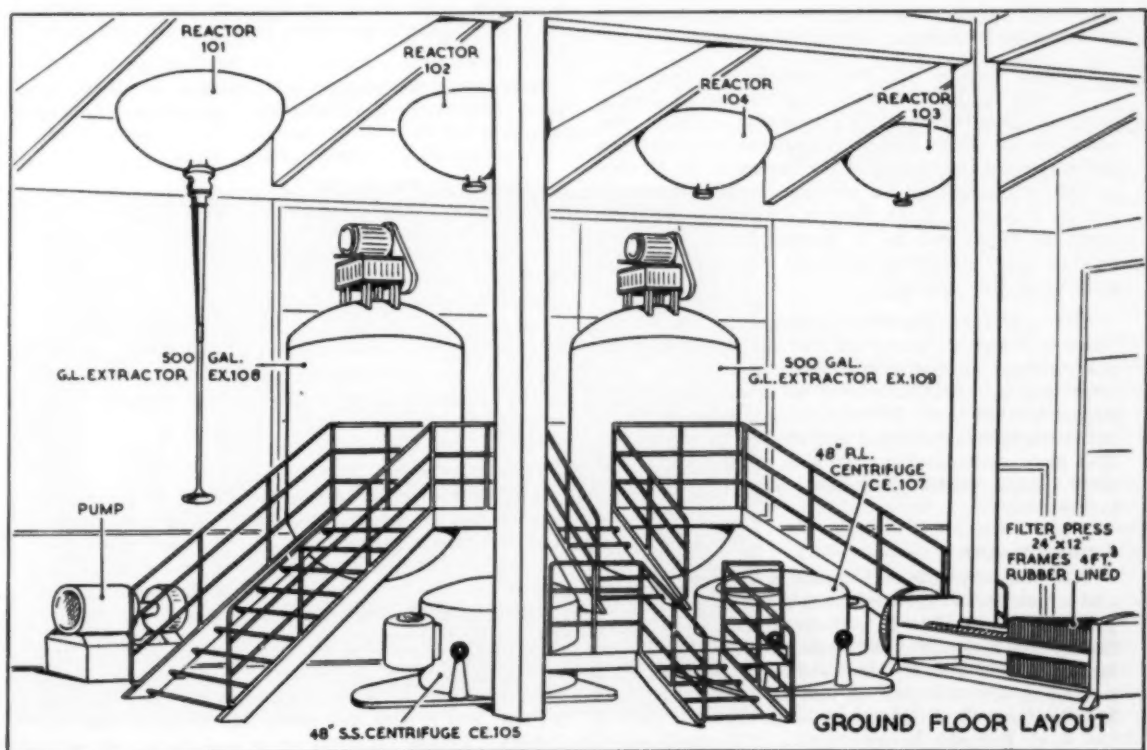
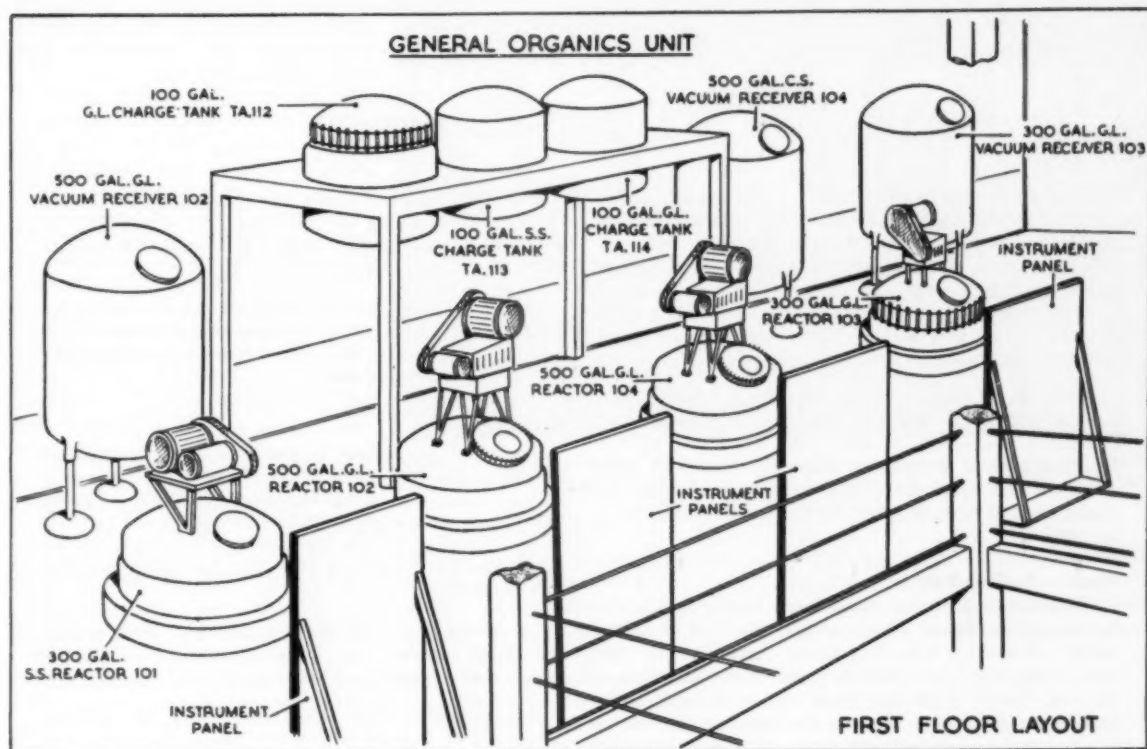
The original flowsheet was drawn up by Merck and Co.'s Engineering Department in New Jersey, U.S.A.

The building design and the detailed equipment design has been in the hands of Morson's own engineering department. Having settled on the main outline of the design, a plastic model of the unit was built to a $\frac{1}{16}$ th scale by Industrial Models Ltd. The equipment layout was settled and the problem of the complicated piping was attacked. Draughtsmen and engineers of both companies co-operated in the building of the model which was used for the design of the piping. The use of a model saved about four months

in construction time. The design period was shortened and problems during installation were simplified by having the model in the building.

From the start of the work on the flowsheet to the commissioning of the unit occupied 24 months, including the time taken to obtain Board approval of the project. Building operations commenced in March 1958 and the project was completed in June 1959.

Apart from the Unit itself, certain services not previously available at Ponders End were installed. These included a 40 TR ammonia



Metamorphosis of a Family Business

THOMAS MORSON AND SON LTD. was founded in 1821 by T. N. R. Morson when he took over a chemist's shop in Fleet Market, London. It was there that he started to manufacture the newly discovered alkaloids. In 1825 he moved to more suitable premises in Southampton Row, and then established at Hornsey the first plant in England for the large-scale manufacture of medicinal creosote.

T. N. R. Morson made a considerable reputation for himself, and was a founder member of the Chemical Society and served as President of the Pharmaceutical Society in 1848; he retired in 1870 and died four years later. For many years before his death he had been assisted by his son Thomas, born in 1825.

Move to Ponders End

Additional premises were eventually taken in Southampton Row, Hornsey and Homerton. The retail pharmacy was closed in 1900 and all the manufacturing moved to the present site at Ponders End in 1901, with the head office remaining in London. One of the reasons for moving the works was to commence manufacture of fine chemicals: these included bromides, citrates, iodides and glycerophosphates; Morsons are the largest makers of the latter in Europe, if not in the world.

Thomas Morson was succeeded by his two sons, T. P. and A. R. Morsons was converted into a limited company in 1915, mainly because the demands for drugs and chemicals for war purposes had increased the extent of the business. T. P. died in 1920 and although his brother lived until 1940 it was T. P.'s sons, T. D. Morson (chairman until his death in 1953) and L. J. Morson (chairman from 1953 until his retirement in 1957) who took over the running of the company.

After a difficult post-war period, the scope of the business widened; many of the old products were discontinued and new chemicals replaced them. This trend was a reflection of the advances in medical science at that time. From 1930 onwards, the range of fine chemicals extended and the works at Ponders End grew considerably. It was at this time that large-scale glycerophosphate manufacture commenced.

A family concern

The company started to make analytical reagents and a number of other products during the ten years prior to World War II. It remained essentially a family concern, and a fifth generation of the Morson family, represented by Mr. Geoffrey T. Morson, M.C., managing director (son of Mr. L. J. Morson), and Mr. Anthony F. P. Morson, works director (son of Dr. A. C. Morson), became active in the business.

The scale of production increased from 1947 and the general volume of business was raised by an energetic sales policy combined with improved methods of manufacture.

In 1955 Mr. E. G. Peppiatt, B.Sc., A.R.C.S., F.R.I.C., joined the company and assumed technical and administrative control of production; he was made a director in 1956.

The merger

During this period a good deal of specialised manufacture had been done for Merck Sharp and Dohme Ltd., and in 1957 agreement was reached in New York for a merger of the two companies as from Merck's point of view it had become increasingly important for them to have manufacturing facilities in this country.

As a result of this merger Thomas Morson and Son Ltd. became the direct subsidiary of Merck Sharp and Dohme Ltd., Hoddesdon, Hertfordshire.

At the same time the head office of Thomas Morson and Son in Grays Inn Road, London, was closed down and with the completion of the building of a new office block at Ponders End the whole of the company's activities are now directed from there.

Soon after the merger the secretary of the company, Mr. A. S. Jerwood, was appointed financial director.

Modernisation programme

During 1957 the company decided to discontinue a great many of their older inorganic chemicals, concentrating on a greatly reduced range for which Morsons have been well known over the years, and also embarked on a fairly extensive modernisation programme to provide facilities for the manufacture of the highly complex organic chemicals which the company are now manufacturing. This culminated in the official opening of the General Organics Unit earlier this year.

Employee welfare

In the course of the past year or so employee welfare has been very much in the directors' minds, and in 1958 a group pension and life assurance scheme was put into operation. This has been followed by the building of a modern and spacious canteen, and a locker and shower room.

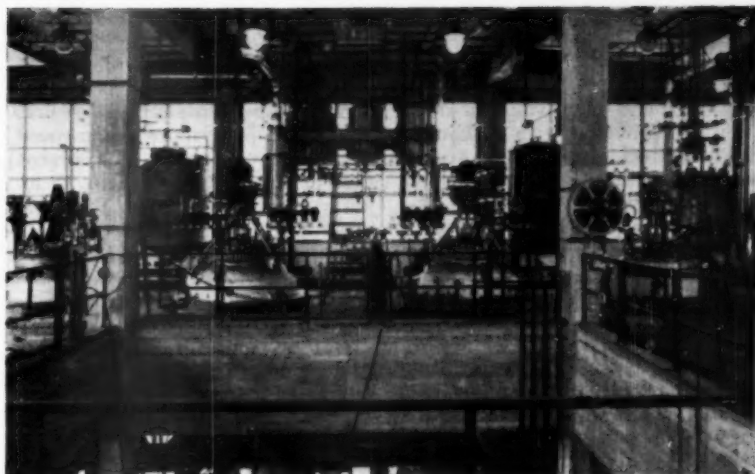
A backbone of the business has always been the close relationship between the Morson family and their employees. This has continued into the new regime, and it is in this spirit that Morsons face the future.

compressor for cooling brine, an additional cooling water tower of 15,000 gal. per hr. capacity, works and instrument air compressors (200 c.f.m. at 100 p.s.i.g. and 60 c.f.m. at 60 p.s.i.g. respectively) a 1,500 g.p.h. acid effluent neutralising plant, a 1,000 g.p.h. deionised water plant and additional electricity supplies.

The building specification was based on a 20-ft. module, allowing for extension in one direction at a later date. The present size is 60 ft. square. Two-storey reinforced concrete construction was decided upon, the main structure requiring fairly deep beams in order to withstand the load of the equipment; the main reactors are supported on ring beams.

The floors are made of acid bricks, the upper one being laid on a plastic waterproof membrane. A central "well" was included to provide easy access to the first floor for equipment installation and movement of materials by air-operated hoist. Internal and external staircases are included, together with explosion type windows, bottom hung and retained by plastic shear pins, which are designed to shear at a pressure of 12-14 p.s.i. of window area. A drying room, partitioned from the rest of the building, and giving space for milling, is located on the ground floor with an office and small laboratory for process testing above.

Open channels provide floor drainage to the 10,000 g.p.h. trade



This shot across the well of the new building was taken before the instrument panels were installed and it gives a clear view of the four reactors on the first floor with the three charge vessels behind.

effluent drainage system, the channels discharging into p.v.c. down pipes. Acid effluent is pumped separately via glass and rubber-lined pipes to the neutralising plant, which works automatically. A pH controller keeps the neutrality of the effluent at a predetermined figure, the solids being removed by the existing sedimentation tanks.

Progress with the building, starting with demolition of an old shed, progressed satisfactorily, but the very wet summer in 1958 hindered operations until the work had advanced sufficiently to make the building weatherproof.

The building is provided with general ventilation at a rate of 8 air changes per hr. Steam-heated radiant panels are used for space heating.

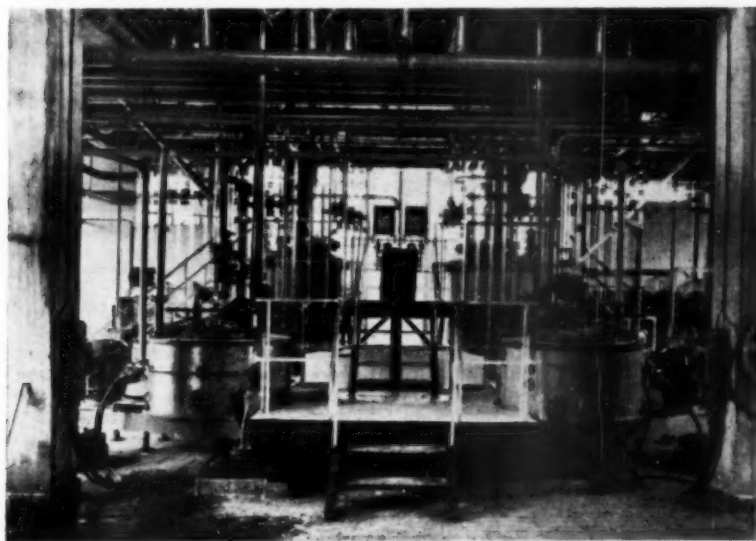
The electrical installation is entirely flameproof, Pyrotex cable being used. In order to prevent corrosion the p.v.c. covered type was selected.

Ring main systems, fed from an overhead piperack from the boiler house, brine unit, etc., supply steam, brine, cooling water, plant air and instrument air, deionised water and mains water throughout the building.

Vacuum is provided on the first floor to the reactors by a Nash two-stage vacuum pump (50 c.f.m. at 29 in. Hg). Each of the reactors can also be heated with hot water from steam/water mixing valves. At all manways, etc., ventilation ducts are fed from a system separate from the general one. In addition, ducting is installed for conveying acid gases, etc., from reactors to a scrubber unit, situated outside the building.

By these means, good working conditions can be maintained, but in case of accidents, the usual safety showers, fire extinguishers and other devices are installed. Another safety feature is the earthing of all glass pipe.

Four 500 gal. reactors have been installed, but allowance has been made for the addition of others. In the places where these will be sited the floor is of pre-cast slabs which, after removal of the acid brick



Plant on the ground floor of the General Organics Unit, including centrifuges and extractors.

floor, can easily be lifted out to make room for additional equipment.

Three of the present reactors are glass-lined and one is stainless steel. They are provided with carbon or stainless steel condensers and can be fed from any of three 100 gal. charge tanks which in turn can be filled by vacuum, or by pump with liquid raw materials from the ground floor. The reactors and their ancillary equipment enable reactions under reflux, distillations, etc., to be carried out.

On the ground floor are two 500 gal. extractor tanks and two 48 in. enclosed $7\frac{1}{2}$ cu. ft. centrifuges. There is also a filter press with 70 sq. ft. filtering area, capacity 4 cu. ft., and a pressure filter with 20 sq. ft. filtering area, capacity $1\frac{1}{2}$ cu. ft. Any of these units can be used in conjunction with the plant on the first floor. This flexibility is achieved by an ingenious and extensive system of piping, 2,500 ft. of which is glass and 6,000 ft. stainless steel.

The laboratory is equipped with Karl Fischer apparatus, pH meter, absorptiometer, etc., and is used for process testing.

The deionised water unit is provided with a 1,000 gal. storage tank and pump; conductivity is continuously measured, a warning bell giving indication that regeneration is required.

Outside the unit is a rubber-lined tank of 1,500 gal. capacity for such operations as "quenching." A 15-20 tons/hr. crusher is installed for crushing the ice and conveying it into the tank.

The equipment, with the exception of a very few small items, was purchased in Britain. Contractors were used for the supply of the necessary labour and supervision for installation of the equipment and materials which were all purchased by the company.

The equipment has been painted in colours, which help to give a pleasant atmosphere. Standard pipe colour coding has been used. The intention has been to give an impression of the unit's function and, in general, to make it possible to achieve a high standard of housekeeping.

Project control was in the hands of the Morson engineers assisted during the piping installation, testing and commissioning by one of the parent company's chemical engineers.

A solvent recovery unit, small tank farm for bulk storage and the necessary piperack to feed the manufacturing area is being installed, thus completing the first phase of a programme commenced about two years ago. The solvent unit consists of a 25 ft. high, 12 in. dia. column filtered with *Spraypak* packing.

A number of products marketed by Merck Sharp and Dohme are being made including chlorothiazide (*Saluric* or *Chlotride*) and *Benemid*. The unit, however, is capable of producing other products without alteration to the present equipment.

RADIATION STERILISATION OF SURGICAL SUTURES

(Continued from page 440)

labour and maintenance costs. A single accelerator needs a competent technician for operation and at least one additional man to assist with the maintenance. Additional staff is required for loading and unloading the product on the conveyors.

Maintenance and repair costs vary again with the type of machine installed. Probably the linac is the most expensive on this score and costs will average \$12.50 per operating hour for replacement parts alone. Most failures in the linac were due to electronic components like diodes, thyratrons and klystrons, but there were some upsets due to misaligned accelerator tubes and out of focus beams. Repairs take from a few minutes to a couple of hours, although more difficult faults like vacuum troubles can take one or two days. The longer time-consuming faults happened very seldom.

Shutdowns on the Van de Graaff are caused mainly by loosening or breaking of the belt or its associated gear. Repairs take at least one day because the tank must be removed each time but shutdowns were infrequent.

Electron beam sterilisation is not cheap. However it is not always fair to make direct cost comparisons with other techniques. Some objects can be sterilised only by using electron beam sterilisation and new forms of packaging can be used. In the case of sutures a better product is obtained.

However developments are under way which promise to cheapen both capital and operating costs. These

together with the cost advantages produced by continuous processing may well make radiation sterilisation as cheap as the "conventional" method of using heat.

Radiation sterilisation is not used by the British branch of Ethicon in Edinburgh because the output of sutures does not at present justify it.

The foregoing article is based upon a paper by C. Artandi and W. Van Winkle Jr., of Ethicon Inc., Somerville, New Jersey, U.S.A.

Autocollimators are used to measure straightness, flatness, alignment, angular rotation and small linear displacements. Hilger and Watts Ltd., who make three instruments of this type, have published a booklet describing their applications and operation.

Glass containers. A well-illustrated catalogue describing their range of glass containers is available from Glas-tics Ltd. Another leaflet from the company describes their method of ceramic labelling. In this the label is screen printed on to the glass and fired, a method which is said to give a permanent label throughout the life of the container.

Publicity That Sticks. This is the title of the latest issue in the new *Sellomation* pocket information series of booklets published by Gordon and Gotch (Sellotape) Ltd. For manufacturers with products selling over the retail counter there is argument and comment to justify the claim that Sellotape "Ad-Strip" is an essential last link in the publicity chain. How to put a slogan across, in point-of-sale outlets already overcrowded with display material, is a problem dealt with in another section. The parcel seal which can also be employed as an advertisement, giving a boost to a new product, for instance, is also described.

Laboratory chemicals. Griffin and George (Sales) Ltd. have issued a price list of laboratory chemicals. The 84 pp. catalogue covers general chemicals, *AnalaR* and micro-analytical (M.A.R.) reagents, microscopical stains, reagents for water analysis and other special items.

Productivity in small firms. The British Productivity Council has published for the National Union of Manufacturers Advisory Service a booklet describing how the Advisory Service has assisted smaller firms, ranging in size from 6 to 300 employees, to achieve substantial increases in productivity and reduction in manufacturing costs.

The booklet consists mainly of case studies describing how 12 typical small firms have, with help from Numas, achieved major improvements in productivity and management organisation.

Electronic Techniques in Pharmacology

By G. W. Cambridge,* B.Sc., PH.D.

In industrial pharmacology it is necessary to examine the effects of drugs on animal tissues in order that their action may be determined before they are administered to man. This may be done on portions of isolated tissue, for example the intestine or heart, or it may be done on anaesthetised animals using suitable apparatus to record the effects of the drug on the various systems, such as the circulatory, excretory, muscular, digestive or central nervous systems. Similar studies may also be carried out using conscious animals. The more detailed information which can be obtained the better, and in this article some applications of electronic techniques to the study of the actions of drugs in animals will be considered.

THE USE of electrical or electronic methods in the examination of the actions of drugs on animals (or man) may be considered under four main headings:

1. The application of electronic devices for the measurement of physical events, such as the flow of blood through the arteries, the force of contraction of a muscle, or the measurement or analysis of the air breathed by an animal.

2. The production of electrical pulses of known parameters for the stimulation of muscle or nervous tissue to provoke responses or to measure the excitability of the tissue.

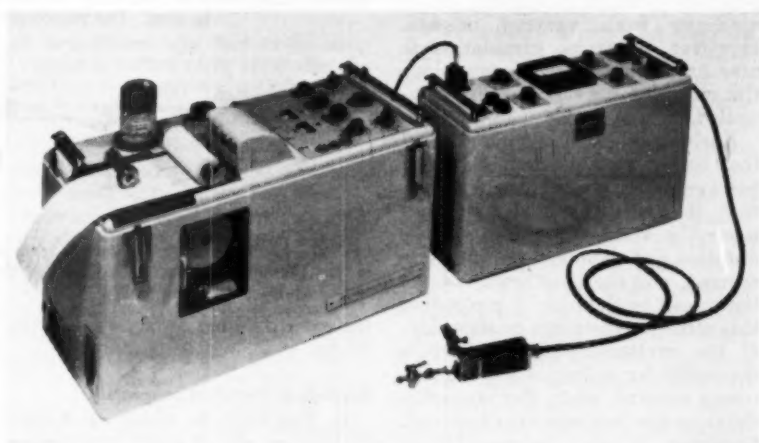
3. The recording of the electrical potentials generated by living tissues and organs which may give an indication of the state of activity of that tissue or organ and permit the observation of changes produced by drugs.

4. The transmission to a remote site of information picked up by electronic units which themselves may be carried by the intact conscious animal without interference with its normal behaviour.

Measurement of physical events

1. The development of physiology has depended to a great extent upon improvement of the methods of investigation. Improved techniques often reveal details that were obscured or even suppressed by some of the earlier recording methods. However, it is not always necessary to use electronic techniques, and an example of this is the recording of pressure changes in the heart and vessels by means of manometers. Membrane manometers using an optical recording

* John Wyeth and Brother Ltd.



The Mingograf 24 direct writing two-channel recorder is designed to record simultaneously two electrocardiograms or other optional phenomena which may contain frequencies up to 900 cycles. On the right is the standard electromanometer for continuous fluid pressure recording. Manufactured by Elema, Stockholm; U.K. agents Sierex Ltd.

system give perfectly adequate records, and much work has been done to perfect this type of system. Nevertheless, many instruments have now been designed to record the movements of the membrane by electronic means, the final recording being made either on paper by a writing device or by photographing the trace on an oscilloscope. Transducer, capacitance or strain gauge-manometers of many types have been evolved. Some are more tedious to use and more unpredictable than the optical recorders, others are entirely reliable, but all may be rendered useless if the final recording device has unsuitable frequency characteristics. The main advantages of the electronic devices are their compactness and portability, particularly as transistor circuits may be used.

An excellent example of the application of an electronic measuring device to the study of drug action in man is the tocograph. This is a strain gauge device which may be fixed to the abdominal wall in the human subject and will permit the recordings of contractions of the uterus. It has been used to assay various oxytocic drugs, and quantitative comparisons have been achieved on the post partum uterus. In general, the problems such as the measurement of dynamic pressures, flow rates, force of contraction, extent and direction of movement, heat loss or analysis of respiratory gases are reasonably straightforward and involve the application of known principles of electronic engineering, but it is to be regretted that too often the results obtained using a nice "black box" with

direct reading meters are accepted without criticism.

Production of electrical pulses

2. Studies of the irritability of tissue using various stimuli have been reported since about 1760 and the term "excitability" was introduced in 1780. In 1786 Galvani made his original observations of the excitability of the frog limb associated with the application of an electrical current arising from the accidental contact of two dissimilar metals. Tissue may also be stimulated by thermal, chemical or mechanical methods and an elegant device was used at one time, stimulation being achieved by dropping fine globules of mercury on to a nerve from varying heights. However, electrical stimulation is now used almost exclusively, since the stimulus may be readily controlled.

Early studies by Lapicque showed that tissues may be excited by the passage of an electric current, but that this effect depends not only upon the voltage but also on the duration of application of this current, and the excitability of the tissue can be defined by measuring this strength/duration relationship. If the excitability of a nerve is depressed by a drug, then this becomes evident when the strength/duration relationships are examined. Similarly, it may be possible to determine whether the drug has affected the nerve alone or has also altered the excitability of the muscle. The technique of electrical stimulation may be applied to the brain and changes in its excitability can be determined in a similar manner. Under carefully controlled conditions, electrical stimulation of a small area of the "motor cortex" may produce movement of a limb or even of a single muscle and the threshold current required to excite the nerve cells in the brain may be determined and effects of drugs upon this may be measured. Of course, not only depression of excitability but increased excitability may occur as the result of action of some drugs. These techniques require very precise control of the electrical stimulus, the induction coil which featured in much early work has been replaced by electronic devices which will give pulses of various shapes, rectangular, exponentially rising or falling, trapezoidal, or sine waves of given frequency, and these allow

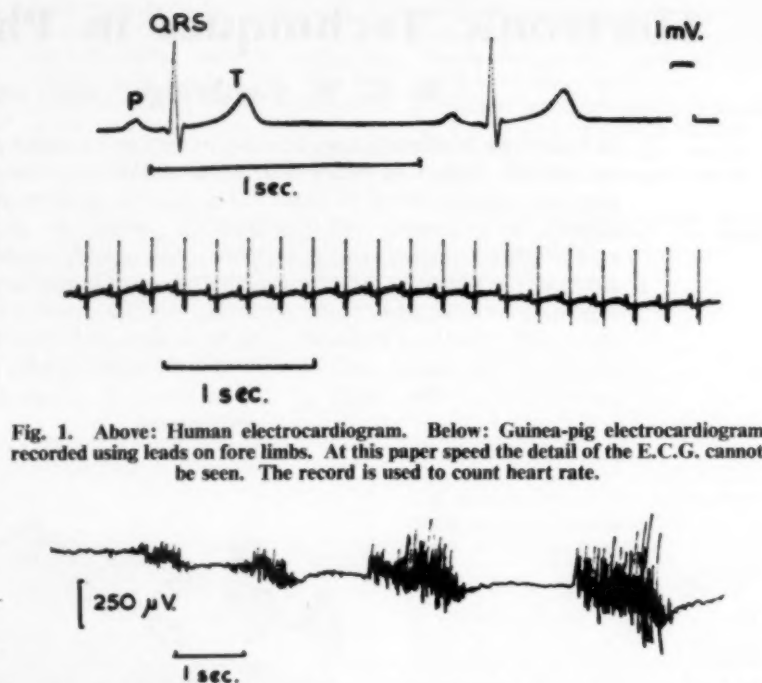


Fig. 1. Above: Human electrocardiogram. Below: Guinea-pig electrocardiogram recorded using leads on fore limbs. At this paper speed the detail of the E.C.G. cannot be seen. The record is used to count heart rate.



Fig. 2. Electromyogram recorded from surface electrodes over flexor carpi radialis muscle (human). The records illustrate the effect of a series of graded contractions.

the more detailed analysis of excitability.

Recording electrical potentials

3. The field in which electronic techniques are of great importance is the recording of electrical potentials which are generated by living tissue. This may be done using isolated tissues or may be carried out in the intact animal. In fact recordings may be made from individual cells and even plant cells show these bio-electric potentials. Generally speaking the inside of a cell is electrically negative to the outside and this is associated with a difference in the ionic concentration inside and outside the cell. In most tissues the potassium level is much greater within the cell than in the external medium. The precise situation differs somewhat in the various tissues, but in a nerve fibre, for example, the potential difference between the inside and outside of the cell may be as much as 70 mV, the so-called resting potential. This was measured (originally) by passing an electrode down the axis of an isolated giant nerve fibre from the squid, these fibres may be up to 1 mm. in diameter, but now the development of micro electrode techniques permits such measure-

ments to be made in single nerve or muscle fibres, which are much smaller than this. The tip of a micro electrode may be as small as 5μ diameter.

The transmission of a nerve impulse is accompanied by a change in the resting membrane potential which decreases and even reverses in sign. This depolarisation may take less than 0.5 m. sec. and is followed by a process of repolarisation. The event is known as the action potential. Records of such action potentials can be made using internal (micro) electrodes or external electrodes (the latter do not allow the resting potential to be measured, since there is no difference in potential along the outside of the nerve). The recording may be made from single nerve fibres which may be as small as 1μ or from the whole nerve, in which case the activity from many fibres will be recorded at once and the resultant picture is more complicated. This electrical event is propagated along the length of the nerve fibre at a speed which may vary from 100 m/sec. to less than 1 m/sec. according to the type of nerve fibre. The nerve impulse may arise from the artificial stimulation of the nerve by an electrical current or from a natural

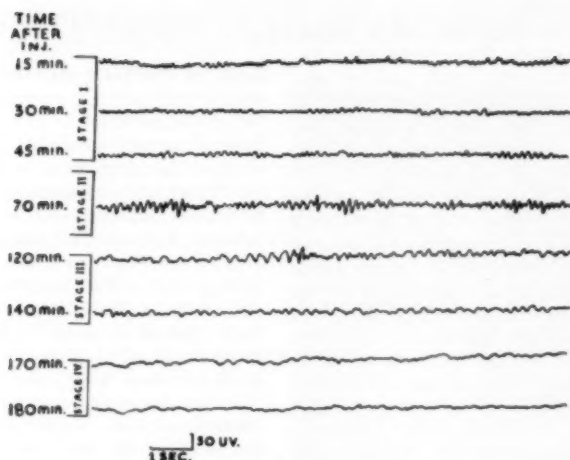


Fig. 3. Electroencephalogram recorded from surface electrodes fixed to the scalp of the cat. The record shows the progressive changes in pattern which occur after the intraperitoneal injection of pentobarbital. These have been correlated with the stages of anesthesia observed in the cat.

process such as the discharge of a sensory nerve ending in response to touch, stretch, pressure, illumination or whatever the appropriate stimulus may be. In every case the action potential is similar and in general the stronger the stimulus the greater the frequency of discharge from the sensory nerve ending. The effects of drugs on the nerve can be assessed from the state of the membrane potential and the action potential and its velocity of conduction; local anesthetics, for example, may be shown to block conduction along a nerve. The effects on a sensory ending can be studied by recording the action potentials in its associated nerve when the end organ is stimulated; this has been studied particularly with stretch receptors. Similarly, muscles produce potentials and potentials also occur at the junction of nerve and muscle, the so-called end-plate potential. Drugs which produce muscular paralysis may be investigated by examining their effect on these potentials; curare for example does not stop the passage of the nerve impulse (action potential) nor the end-plate potential, but it prevents the appearance of the muscle action potential and produces neuro-muscular block. Other neuro-muscular blocking agents may be shown to act in different ways.

Up to this point these electrical events have been considered as local ones which must be recorded through electrodes placed in or on

the tissue, and the tissue or organ itself must of necessity be exposed. There are, however, potentials which can be recorded without necessity for placing electrodes on the organ which is generating the potentials. An example of this is the potential change associated with each heart beat, the electrocardiogram (E.C.G.). What is recorded is not the action potential of heart muscle but the overall potential change measured between two electrodes placed on the surface of the body, either on both arms or an arm and a leg or over the chest. The potential is quite large, about 1 mV, and its shape is determined by the geometrical position of the electrodes. If recordings are made between several pairs of electrodes much information can be gained about the activity of parts of the heart and even about its axis within the chest. The main waves in the E.C.G. have been given the code letters P, Q, R, S, T. The first or P wave is associated with contraction of the auricles, the Q, R, S complex represents the spread of excitation into the ventricles and precedes contraction, and the T wave is associated with events in the ventricles. These changes follow in normal and regular sequence, but if a drug is given which blocks the conduction from auricles to ventricles this will be seen in an alteration of the P-R interval, and there may be even two or more P waves before the occurrence of Q, R, S, T, a condition of heart block. Conversely heart

block may be experimentally induced and drugs which prevent or reverse this may be examined.

A further use of the E.C.G. in pharmacology is the assay of digitalis by its effect on the time course of the E.C.G. in human subjects. The E.C.G. may also be used to count heart rate and this may be the only reliable way of counting the very fast heart rate of several hundred beats per minute in small animals. As the potential change is large it is readily recorded; early workers used a string galvanometer, and indeed several instruments of this type with optical recording are still in use, but many electrocardiograms are recorded via amplifiers and a pen recorder.

The actions of muscles may be recorded using electrodes placed on the surface of the muscle, since the potentials developed are again fairly large. An application of this is in the examination of drugs which modify muscle tension, the change in the electromyogram (E.M.G.) indicating whether the spontaneous activity in the muscle is greater or less than normal. Centrally acting drugs used to relieve the spasm of tetanus have been assessed in this way, the voltage of the spikes of the E.M.G. being fed into an integrating circuit so that a numerical index of the state of activity of the muscle before, during and after the administration of a drug may be obtained. More detailed studies of the electrical activity of muscle can be obtained by inserting into the muscle, electrodes in the form of a hypodermic needle carrying within its bore a wire, insulated except at the tip. The discharge of single motor units can be picked up by this means and a more detailed analysis may thus be achieved.

Electrical activity of the C.N.S.

The electrical activity in the central nervous system is, of course, of great interest. The spontaneous oscillations of potentials were first recorded in 1925 using a string galvanometer, although such oscillations had been observed but not recorded in the early 1870s. Since this time there has been much careful analysis of the origin and nature of these "brain waves" and attempts to relate them to the state of activity or functioning of the brain. These potentials may be picked up by electrodes placed on the skull, such a record being known as the electroencephalogram

(E.E.G.) and the potentials have an amplitude of 10 to 100 μ v. Recording of such potentials requires stable high gain amplifiers. Electrodes can also be placed on the surface of the brain either after its exposure or by inserting steel screws through the skull; such recordings are called the electrocorticogram (E.Co.G.) and these potentials may have considerably greater amplitude than the E.E.G. Furthermore, electrodes may be placed in the brain tissue in order to record the activity arising from various structures within the brain. The E.E.G. in man may be briefly described as an electrical oscillation with a dominant frequency of 9 to 11 c/s (alpha rhythm). There is some activity at double this frequency and a number of other components of smaller amplitude. This normal pattern is profoundly altered by such events as sleep, general anaesthesia or the administration of centrally acting drugs. The changes may be observed both in the amplitude and the frequency of the potentials and this may be studied in more detail by the use of frequency analysers. By observation of the pattern obtained from pairs of electrodes distributed over various areas of the skull the site of origin of some components of the E.E.G. may be determined, and by these means some indication of the site of action of drugs may be achieved. Similarly, the E.Co.G. may be used, the electrodes being affected by activity occurring in a few square mm. corresponding to hundreds of neurons. Some restriction of the effective zone can be achieved by putting into the cortex wires 30 to 50 μ in diameter insulated except at the tip, and these may be placed at various depths within the brain. Smaller electrodes less than 5 μ at the tip have also been made for recording from groups of cells or from single cells. The types of response of the E.E.G. and E.Co.G. to the administration of various drugs are too complicated to be described here, but analysis of the changes which are produced may provide information about the site or nature of their action.

Transmission of information

4. The use of some of the techniques mentioned above has been limited by the fact that the conscious animal is not readily connected to electrodes unless some

form of restraint is used. This is undesirable; on the other hand, records using fine electrodes implanted into the skull may be distorted and rendered useless by the presence of long trailing leads connecting the animal to the amplifier. This has been overcome by the design of transmitters which can be carried by the animal from which a signal can be received at a remote point without intervening wires. This was first done with the electrocardiogram in conscious dogs and was later extended to measurements of arterial pressure using a capacitance manometer inserted into a suitably prepared artery. The transmitter itself was, however, quite large and was carried in a pack, being suitable for large animals only. More recently the use of transistors has allowed the construction of smaller transmitters which have been used in conjunction with micro electrodes inserted into the brain. The transmitter and its power pack are small enough to be carried on a light harness on either side of the chest of a cat with the aerial between. At the moment an amplitude modulated system has been used because of its relative simplicity, and signal strength variations are compensated for by incorporating in the receiver a system for automatic gain control with a time constant short enough to follow the movements of the cat but long enough not to interfere with the physiological signals from the brain. A frequency modulated system may be used to overcome this difficulty in signal strength.

The possibilities of telemetering in physiological research are enormous and, in view of the intensive research in the investigations of outer space using this type of equipment, progress in the biological field might well be accelerated if adequate co-operation between the sciences could be achieved.

Summary

A very limited number of applications of electronic techniques to the investigation of the physiological background of the action of drugs in animals has been described. The analysis of bio-electric potentials which may be recorded from the intact unrestrained conscious animals may provide entirely new means of determining the action of drugs.

Correspondence

List of Surface Active Agents

TO: THE EDITOR

SIR: You will probably be aware of the existence of the complete list of surface active agents available in America, put out by the American journal *Soap and Chemical Specialities*. This lists over 1,000 products, giving very brief details of each, including trade name, manufacturer, chemical class and formula, main end-use, form, % active concentration, type, and remarks.

I am preparing a similar list of British surface active agents for publication in this country and would like to enlist the help of manufacturers through your columns.

Would manufacturers kindly send to me a full list of the surface active agents they manufacture, giving as much information as possible, but at least the details set out above. Data sheets would be appreciated but are not entirely essential.

You will no doubt agree that a list of British surface active agents would be a valuable asset both in this country and abroad.

My list is intended to cover all manner of surface active agents, including detergents, wetting agents, emulsifiers, solubilisers, etc.

E. S. LOWER.

Director.

*Croda Ltd.
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Electro-heat. A brochure from the British Electrical Development Association describes the types and applications of various methods of industrial heating by electricity. Films, both 16 and 35 mm., covering the production and use of electricity are also available on loan from the association.

Acetophenone. New data on the reactions and pharmaceutical applications of acetophenone are outlined in a 12 pp. bulletin, RF-6970B, issued by Union Carbide International Co. In the pharmaceutical industry, acetophenone is used as a soporific and hypnotic. Its derivatives are used in a variety of pharmaceutical compounds, among them the penicillin salt which has a prolonged antibiotic effect. Acetophenone can also be reduced to phenyl methyl carbinol, a base and fixative for perfumes.

Riker Laboratories' New Factory

A NEW factory for the production and packaging of tablets and therapeutic aerosols has been opened by Riker Laboratories Ltd., at Wharncliffe Road, Loughborough. The company is the English branch of Riker Laboratories Inc., a wholly-owned subsidiary of the Rexall Drug and Chemical Co., and it has been established in Loughborough since 1954. The new factory was taken over as a shell earlier this year and the interior was designed entirely by Riker's production staff.

Cost of acquiring and equipping the factory was in the region of £70,000 and about 120 persons will be employed there. It provides 20,000 sq. ft. of working space and a further 5,000 sq. ft. are available for future expansion.

Employee welfare is catered for by a well-equipped first aid room and a resident nurse. Automatic vending machines supply hot and cold drinks during morning and afternoon breaks, and there are canteen facilities in the main building in Morley Street.

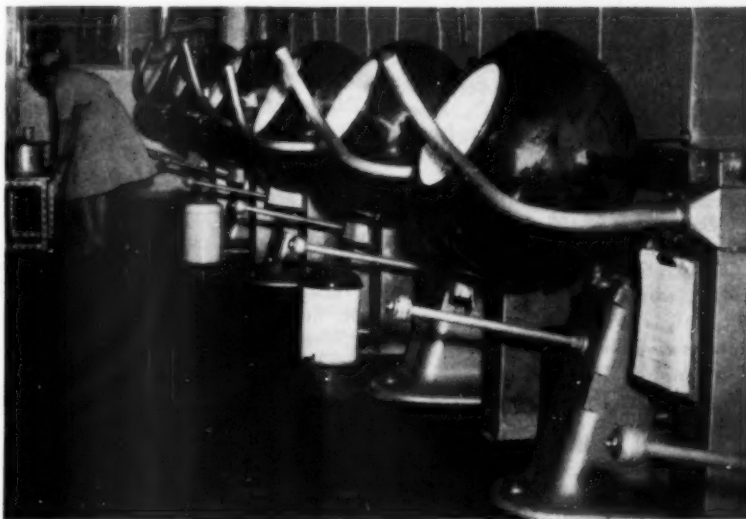
Manufacturing facilities comprise tablet granulation, compression and coating and an aerosol filling unit. There are six lines in the large production hall for handling a wide range of tablet specialities. Capsules, gels and aerosols are packed in containers ranging from glass bottles of all shapes and sizes to tubes, aluminium containers and stainless steel vials. Layout is arranged so that raw materials enter one end of the building for storage prior to processing, and finished goods leave at the other for the warehouses in the main Rexall-Riker building in Morley Street.

Materials flow

From the store raw materials move into the granulating and premixing department for preliminary processing. Equipment in use here includes two Manesty "300" premixers and Alite, Winkworth and Peerless machines. After granulation the materials pass to the tableting room where they are fed to six Manesty tableting machines. These include "D3A" and "BB3A" models, used for the production of APC, aspirin and yeast tablets, and "F3," "BB3B" and "D3A" for the production of *Super Plenamins*, a multivitamin



Mr. Justin W. Dart, president of the Rexall Drug and Chemical Co. Ltd., inspecting one of the conveyor lines in the packaging hall. From left to right: Mr. J. A. Lumley, managing director of Riker Laboratories; Mr. Holmes Tuttle, managing director of the Rexall Drug and Chemical Co.; Mr. J. W. Dart and Mr. E. A. Burfoot, works manager of Riker Laboratories.



A view of the air conditioned tablet coating department.

product. Each machine is capable of an output of more than 500,000 tablets a day. Moisture content of the granules is checked electronically before compression. *Super Plenamins* are manufactured in an air-conditioned room in which air at a constant humidity and temperature is circulated by a Birlee dehumidifier. The air-conditioning equipment cost about £3,000.

Tablet coating and packing

After compression the tablets pass to another air-conditioned room where they are coated and polished in eight Manesty coating pans. The coated tablets are inspected on a C. E. King tablet inspector and then pass to the packing hall. Among equipment used here are a Kalex Dupuy tube filler, several Triumph electronic

tablet counters and a disc tablet counter.

Aerosols

The company manufactures *Medi-haler* metering aerosols for the treatment of asthma, obtaining the valves for them from Neotechnic Engineering Ltd., a company the Rexall Group acquired earlier this year.

In producing the *Medi-haler* the first step is the reduction of the drug used to the correct particle size by micronising. The powdered drug, together with other ingredients, is mixed with a non-volatile *Arcton* by a mechanical mixer and the paste is then mixed in a colloid mill. The *Arctons* are mixed by weight in a large pressure vessel standing in a bath of *Drikold* CO₂ in alcohol at a temperature of -45°C. Propellant is forced up as required into an aspirator, also maintained at -45°C., from which it is metered into the vials.

An electric metering pump fills the vials with concentrate and they then pass, *via* a moving belt, to another operator who meters a charge of propellant into each. Valves are placed on the vials as they move along the belt to a rimming machine and, after rimming, they travel to a test bath containing water at 55°C., where "leakers" are picked out by an operator protected by a face shield. Finally, the vials are tested for efficient valve function.

Micronising of the drug, metering of concentrate and metering of propellant is carried out in dehumidified air.

Process steam

Steam for the various processes is provided by a new type of Clayton steam generator, model "RO.50," with an output of 1,673,750 B.T.U./hr. and a thermal efficiency of 75-80%. In it steam is raised only as required on the flash evaporation principle. It is one of the first of this size to be installed in Great Britain.

Extensive use is made of conveyor belts in the packaging hall, and transport and storage of materials is facilitated by palletisation and the use of a Yale *Worksaver* fork lift truck.

Rexall expansion in Britain

The coming into service of the Wharnclyffe Road factory now



Filled aerosol vials being tested in water at 55°C.

brings the number of production units in the Rexall Group in the United Kingdom to four. Following the purchase of Carnegies of Welwyn early in 1959, the organisation now owns a modern fine chemical plant close to London, and the engineering company mentioned above, Riker Laboratories Ltd., the largest company in the Group, was formed in 1951. It now employs over 270 people and markets prescription-only products. More than 50 representatives call on doctors in Great Britain. Overseas representatives in the West Indies and South-east Asia bring information of new product development to doctors in these areas.

The Rexall Drug Co. sells an extensive range of medicinal preparations for over-the-counter sale. Rexall and Riker products are available through agents in most of the principal countries of the world.

Carnegies of Welwyn concentrate solely on the manufacture of fine chemicals. They are producers of caffeine, and salts of quinine, strychnine, brucine and other alkaloids. Bismuth compounds are another important product.

In the United States, the Rexall Drug and Chemical Co. has developed its interests considerably during the past few years and now has large and important interests in plastics, rubber, fine chemicals and pharmaceutical products of all kinds.

Industry's Publications

Chemical Words is the subject of a paper delivered at the last meeting of the American Chemical Society in Atlantic City. This explains certain aspects of trade marks, trivial, generic and special technical words as used in science and industry. It describes the system used in compiling and maintaining a file giving the chemical composition, use and source of many chemicals and chemical products. A copy of this paper is available from the Cheminform Institute, Coliseum Tower, New York 19, N.Y.

Centre-Line Indicator-Controller. A pamphlet from Cambridge Instrument Co. describes a new instrument incorporating a novel display of the "Desired" and "Measured Values." When the pointer lines up with a fixed datum on the centre line of the scale, the plant is "on control," and any change in this condition is immediately visible, even from distances at which scale graduations cannot be read. The instrument is supplied for either ON-OFF or time modulated 3-term control.

Wool grease and its derivatives. The City of Bradford By-products Department has been producing wool grease for over a century and is now the greatest single producer in the world. From the vast amount of information it has collected, the Department has produced a booklet summarising the properties and applications of wool grease products. Sections are devoted to particular products, for example: sodium soap, fatty acids, magnesium soap and special products. There are many useful formulae and an index.

DETERGENTS and Detergency

By Leon Raphael, M.Sc., F.R.I.C.

*Perfuming detergents • Improved soap • Recovery of oil • Specialities
Alkanolamides • Tall oil • The U.K. market • Consumer survey
of detergents*

THE TOTAL sales of soaps and synthetic detergents in the United States has remained constant at 4,000 million lb. a year over the past two years or more.¹ Synthetics in 1958 increased their share of the market over the previous year by 1.2% and now cover 72.2% of the total. The greatest increase was in liquid detergents. This trend is being helped by the introduction of a home washing-machine equipped with a tank for liquid detergent and a press-button dispenser.²

Perfuming problems

One of the problems in the marketing of liquid detergents is successful perfuming.³ Some detergents deodorise perfumes or weaken them. This may occur by a saponification process which is catalysed by amyl or benzyl salicylates. Although most perfumes are soluble in detergents, a turbidity may result when diluted with water. Since most detergents contain an undesirable odour, perfumes are necessary to mask it. The choice of perfume must be varied according to the application. For example, a pine perfume for disinfectants, a citrus type for dish washing. High boiling alcohols such as terpineol or geraneol are fairly stable to the conditions which detergents undergo. The average perfume content of detergents is 0.2% which in the United States represents 5 million lb. of perfume a year.

Toothpaste requirements

About 1 million lb. of surfactants are used each year in the United

States in the manufacture of toothpaste.⁴ These are mainly acyl sarcosines and fatty alcohol sulphates. Such syndets give better foam and flavour than soap and are more stable. When manufacturers changed over from soap to syndets, adjustments to the formula were necessary as changes in viscosity and stability of the paste ensued. A low chloride content is essential to prevent corrosion of the aluminium tubes.

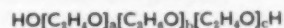
Improvements in soap

Attempts are being made to improve soap in its fight to retain its share of the market. There is still a preference for soap in soft water areas and water-softeners enable the less fortunate to overcome the troubles of lime soap precipitation. One of the most successful ways of meeting the sales competition is by incorporation of syndets into soap-bars or using special additives to make soap unique in its properties.⁵ Soap is less irritating to the skin and less toxic than syndets. The bactericides hexachlorophene, bi-thionol and trichlorocarbanilide are most effective in a soap medium. In the treatment of fabrics, however, the cationics are more successful. Soap has excellent soil suspending properties and requires no builders such as polyphosphates. It imparts a lubricity and softness to fabrics.

Petroleum recovery

The displacement of oil from wells is achieved by flooding with water. By such conventional methods only one third of the oil reservoir can be

recovered, the remainder being held tightly by sand and rock. An increased yield can be obtained by using detergents, which help to displace the oil from the hydrophobic surfaces more efficiently. The use of surfactants also enables the recovery to be carried out with lower water-pressures, so reducing the pumping costs. The choice of detergent must be carefully made for if the surfactant itself is too strongly adsorbed by the rocks, the required concentrations becomes uneconomically high. The most suitable surfactants for this application are non-ionics of the Pluronic type, which are not easily adsorbed on the inner surface of an oil well. Pluronic L.64 in water is adsorbed to the extent of only 0.225 micromoles per gm. of quartz. The alkyl phenol ethers under the same conditions are adsorbed 20 to 100 times as much and would, therefore, be too costly.⁵ The Pluronics, made by Wyandotte, are block polymers in which polypropylene oxides of molecular weight greater than 1000 are the hydrophobic groups. When reacted with ethylene oxide the products are of the type



where a, b and c are integers. By labelling the ethylene oxide portion with radio-active carbon ¹⁴C, the degree of adsorption can be followed. Spectrophotometry can be used with other non-ionics, but the Pluronics do not absorb in the U.V. or visible regions. One mole of Pluronic L.64 occupies an area of 2880 square angstroms compared with 35 to 200 sq. Å for the alkyl phenol ethers. Low adsorption results in more rapid movement and has been explained as due to the large size of the hydrophobic group of the Pluronics.

Speciality surfactants

While the large chemical companies can mass-produce successfully and cheaply those products in great demand, they find it uneconomical to manufacture special products, vitally important in many industries, but for which the demand is small. To meet these requirements, a small company can

often step in to fill the breach. In the United States, one small company specialises in tailor-making syndets required for particular industries.⁶ The polyglycol esters are numerous and can be blended to give the particular properties required. In 1955 this company produced 100,000 lb. per month of specialities, and by 1958 the tonnage had increased five-fold, covering 350 products.

The processes required are in general simple and the reactors are multipurpose. Manufacturing on a small scale, stainless steel or glass-lined reactors can be constructed without prohibitive expense. To minimise permanent piping, pumps are mounted on portable stands and connected with flexible tubing. This company have six small-scale reactors which can be so arranged that they can all be used simultaneously and controlled by two operators. In addition, the company operate two 500 gal. stainless steel pressure reactors for ethylene oxide and propylene oxide derivatives. All the necessary safety precautions have been covered, including an automatic alarm signal to indicate increasing pressure and a gas analyser to confirm the absence of oxygen in the system. (Ethylene and propylene oxides form explosive mixtures with oxygen.)

One of the problems facing this type of company is bulk-buying, since the product requirements may change from day to day. Both water-soluble and oil-soluble surfactants are produced. Lauric acid heated with monisopropanolamine or diethanolamine at 160°C. produce water-soluble products, while oleic acid or castor oil with diethanolamine form oil-soluble syndets. Lauryl sulphate, which is mainly used in shampoos, is made by reaction of lauryl alcohol with chlorosulphonic acid. HCl gas is removed by vacuum. The viscosity of the pastes can be controlled by addition of salt. If ammonia or ethanolamines are used to neutralise the lauryl sulphate in place of caustic soda, wetting and detergent action are enhanced. The addition of lauric diethanolamide produces concentrated liquids used in bubble-foam baths. The glycol esters of fatty acids used as emulsifiers in foods contain both mono- and di-esters, when manufactured by conventional means. This company can produce esters with a high mono-ester content. The polyglycol esters

can be made either by reaction of glycol with the fatty acid or by treating the acid with ethylene oxide. The latter process gives surfactants, with superior properties in certain applications over the former process (direct esterification). Such properties are necessary in insecticide emulsion preparations and in heavy duty detergents. Quaternaries have a very small share of the market. They are used as bactericides and corrosion inhibitors. Here, again, a small company fulfils a useful purpose in making small tonnages of tailor-made products.

Alkanolamides

These form 5% of the total surfactant market.⁷ They may be prepared by reacting a fatty acid and an alkanolamine at 150°-170°C. The alkanolamines used are monoethanolamine, diethanolamine, isopropanolamine and amino ethylethanolamine. Glycerides may be used in place of fatty acids giving glycerol as a by-product. The commercial products are generally condensates containing equimolar quantities of acid and amine, known as 1:1 condensates. Coco-, lauric-, myristic-, stearic ethanolamides are waxes melting between 76 and 96°C., in the order given and are not very water-soluble. The isopropanolamides are more dispersible in water and melt at about 20°C. or lower. C₁₂-C₁₄ derivatives are used in spray-dried household detergent powders as foam stabilisers for alkyl arylsulphonates and alcohol sulphates. Their use in liquid detergents is limited by poor solubility at low temperatures requiring the addition of solvents such as alcohol.

Hydroxyethyl stearamide is used as an opacifier and pearling agent in cream shampoos. The diethanolamides prepared commercially as 1:1 condensates are mixtures containing a high proportion of ester amine and ester amide. When two moles diethanolamine are reacted with one mole of coconut fatty acid, the diethanolamide R.CO N (CH₂ CH₂ OH)₂ forms about half the total product which is water-soluble. Unreacted diethanolamine forms 28% and there is about 3% of free fatty acid. The remainder of the product is equally divided between ester amine and ester amide. This type of alkanolamide was patented by Kritehevsky in 1937 and is used successfully in heavy duty liquid

detergents. These products are not suitable for spray dried powders as they impart tackiness. They are claimed to reduce redeposition of soil, static electricity on fibres and corrosion of metals as well as being synergistic to the performance of alkyl-aryl-sulphonates. A very pure 2:1 condensate can be prepared from diethanolamine and the methyl ester of the fatty acid using sodium methoxide as a catalyst. However, the product undergoes a rearrangement yielding the equilibrium mixture of similar composition to that described above. Amino ethanolamine produces 90% alkyl diethanolamide with no ester formation. The stearic acid derivative is used as a softener for synthetic fibres and the oleic acid derivative is a petrol additive preventing stalling in icy weather. It reduces deposits in the carburettor and manifold and is a corrosion inhibitor.

Alkanolamides are being incorporated into toilet soap bars to improve foam characteristics and act as lime soap dispersers.⁸ Monoethanolamides of lauric and myristic acids are solids melting around 80 to 90°C. This is somewhat higher than the temperature at which soap is plodded, but by pulverising and passing through the plodder several times with soap chips, they can be satisfactorily blended. Alternatively, alkanolamides can be added to the molten soap in the crutcher. The monoisopropanolamides have lower melting-points and blend into soap more easily. Used as 2.5% in toilet bars, alkanolamides improve creaminess and stability of lather. They are claimed to enhance the retention of perfume on the skin after washing.

Tall oil

There has been an increasing interest in tall oil as a source of raw material for synthetic detergents. Since 1940, the production of tall oil in the United States has increased twentyfold and is now over 600 million lb. a year. Less than half the tall oil acids comprises fatty acids, the remainder being rosin acids. Nevertheless, the fatty acids content is greater than the total oleic acid production in America. The low and stable price of tall oil is expected to increase demand to 1500 million lb. by 1975. In certain applications the tall oil as a mixture of fatty acids and rosin acids is found to be superior to fatty acids alone.⁹

Tall oil is produced during the conversion of wood to paper. The wood is digested with alkali in an autoclave, the soaps are washed out with liquor, concentrated in a multi-stage evaporator to 20% solids and salted out. After acidification at 200°F., followed by cooling, three layers are formed; brine (below); lignin (middle); crude tall oil (above). Separation is achieved by gravity in a batch process or centrifugally in a continuous process. The crude oil contains 35 to 65% acids. By heating at 185°C. under vacuum, water is removed and the oil is then fractionally distilled at 500°F. Decomposition of the fatty acids may occur during distillation with the formation of anhydrides, ketones or oxidation products. This is largely overcome by the use of stainless steel vessels with a minimum of molybdenum (2.5 to 3.0%) and limiting the residence time at high temperature. Steam-injection reduces the anhydride formation. The distilled tall oil is stored in aluminium or stainless steel tanks under inert gas. The fatty acids are approximately equally divided between oleic and linoleic acids which on hydrogenation produce a very pure stearic acid. The tall oil fatty acids condensed with ethylene oxide form non-ionic polyglycol esters for incorporation in detergent mixtures.

After fractional distillation of tall oil, a high boiling residue remains which when heated with dilute alkali forms water-soluble soaps of fatty and rosin acids and an insoluble wax known as *Lanofat* consisting of esters and unsaponifiables.⁸ The esters result from the reaction of fatty acids with sterols and alcohols present in the crude tall oil. In this respect it is similar to lanolin, which is composed of cholesterol esters of long chain fatty acids. *Lanofat* resembles crude lanolin, having a similar melting-range and is a stabiliser for water-in-oil emulsions. It has a higher iodine-value than lanolin and is dark in colour, although it can be bleached.

The British market

In 1946 detergent sales in the United Kingdom formed about 10% of the total soap and detergent market (as active ingredient). Now they comprise well over half the total production of 350,000 tons.¹⁰ As in the United States, liquid detergents have taken an active

part, but not to the same extent as powders as they are limited to light duty detergents. During the post-war growth period, powdered products have increased their share of the syndet market from 20 to 90%. Four-fifths of the total detergents trade in Britain are used for household purposes and the principal manufacturers, of course, are Hedley's and Lever's, who between them hold 95% of the market. The largest used product is *Persil*, a soap-based powder, which holds 40% of the market. There are many more synthetic based products, the largest share of the market being held by *Tide* (20%). Soap has lost ground among washing powders, its share having fallen from 70% in 1951 to 50% in 1958.

Public prejudices towards syndets are being overcome. The market survey shows that 50 to 60% of the public prefer syndets; 20 to 40% prefer soaps and about 15% are undecided. All syndet manufacturers have increased their sales campaigns and it is estimated that on each of the main products, £500,000 a year is spent on advertising, representing about 10% of turnover. Price-cutting has of course been used as a further incentive to encourage the buying of syndets. All these efforts seem to have had the desired effect.

While Shell, I.C.I. and Marchon are the principal suppliers of surfactants for industrial purposes, Hedley's and Lever's who previously confined themselves to the domestic market have begun the manufacture of industrial detergents.

Consumers Association survey

Which?—the journal of the Consumers Association Ltd.—performs a valuable public service by suggesting the most economical way of spending their money. Recently, they conducted an enquiry in detergents and their findings were published in the September 1959 issue. They begin by asking why detergent manufacturers spend £7 million a year on advertising, to the annoyance of the public! Analysis shows that many of the well-known detergent powders contain 20 to 30% alkylaryl-sulphonate, up to 9% perborate and 25 to 35% phosphate. Perborate is an effective bleach above 140°F. for removing tea or coffee stains, but it may alter the colour of woollens if used carelessly. Optical brighteners, if used in excess, can cause a bluish tint

on the fabric. Liquid detergents mostly contain non-ionic and anionic surfactants. None of the liquids listed appear to be heavy duty products. *Stergene* seems to have lost ground in the past few years. This product was originally based solely on a non-ionic, but now contains an anionic, in addition, to improve foam and performance. These improvements do not seem to have had the desired effect on consumers. Nevertheless, this survey reports that *Stergene* gave very good performance.

The advantages of syndets over soap in hard-water areas are well known. In soft water, built syndets are as successful as soap in washing fabrics and in general the report recommends their use. The effects of all types of detergents on textile fibres is similar. Discoloration of all textiles except cellulose acetate was observed, but the strengths of nylon and *Terylene* were not reduced after several washings. While foam is a useful guide for active concentration of soap, this is not so for syndets. The housewife is warned not to exceed the dose of a tablespoonful of powder to a gallon of water; to dissolve the powder rather than allow the solid to contact the garments. Cream colours may be changed by optical brighteners to a pinkish white. The excessive use of detergents can be uneconomical as well as damaging.

With the exception of one product (*Zero*) all the powders examined were found to be inexpensive (2s. 6d. to 3s. a lb. on an active ingredient basis) and similar to soap. Among the liquids, *Stergene* was the cheapest, while *Dylon* was the most expensive, due to the type of container, which is very convenient for travelling purposes.

As regards the dermatitic effect of synthetic detergents, the report states that there is no evidence that they are any more harmful than soap. Prolonged use may make the skin very dry and cause cracks, allowing bacteria to enter. In general, the report says that syndets perform efficiently and give good value.

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10. *Discovery*, 1959, 20, (8), 344.

BOOK REVIEWS

Pharmazeutisches Worterbuch

von Curt Hunnius. 3rd edition. De Gruyter and Co., Berlin. Pp. xii + 731. DM32 net.

READERS of the German pharmaceutical literature will find this a useful work. It is an encyclopædia as well as a dictionary. The explanations are in German. Plants, animals, organs, drugs and compounds are dealt with under Latin names, with references from the German names. Preparations in the *Deutsches Arzneibuch* (6th edition) and its supplement are shown by symbols, and this book is thus also a summary of the German pharmacopœia.

The terms chosen relate not only to pharmacy but also to bordering fields. The explanations are clear and to the point. Empirical formulæ are given for pure compounds (and structural formulæ for the more complex) together with the usual constants, pharmaceutical applications and doses.

D. J. C.

Aspects of the Organic Chemistry of Sulphur

By F. Challenger. Butterworths, London. Pp. 253. 40s. net.

PROF. CHALLENGER ranges widely over his chosen subject in these six essays on organic sulphur compounds. He writes with the confidence and comprehensiveness of one who has spent many years in the laboratory studying sulphur compounds. He has selected his subjects either because of their fundamental importance or because of their special interest to organic chemists, biochemists and those working in pharmaceutical and petroleum chemistry. In the first chapter he deals with mercaptans, sulphides, sulphoxides, sulphones and disulphides. In the next with natural sulphonium compounds, and in the third with compounds of oil and tar. Chapter four is given over to mustard oils, chapter five to biological methylation in moulds, higher plants, animals and man, and the final chapter to Co-enzyme A and its S-acetyl derivative.

Readers may remember Prof.

Challenger's article on organic compounds of sulphur which appeared in the April 1954 issue (pp. 151-7). Some of this is embodied in the present book.

Bookshop Service

All books reviewed in MANUFACTURING CHEMIST and all other scientific or technical books may be obtained from: Technical Books, 308 Euston Road, London, N.W.1. Telephone: Euston 5911.

Encyclopædia of Chemical Reactions

By C. Jacobson et al. Vol. 8. Reinhold, New York, and Chapman and Hall, London. Pp. 533. 112s. net.

THIS is the final volume and the completion of the *Encyclopædia of Chemical Reactions*, an arduous labour of love that has taken many years. This volume includes entries on the reactions of tungsten, uranium, vanadium, ytterbium, yttrium, zinc and zirconium. Following these is an Addenda section comprising entries received since the publication of earlier volumes and containing reactions of the elements with which they are concerned. These addenda take up nearly 200 pages. There are two substantial indexes, one to reagents and one to the substances obtained. Like its predecessors, the book is well printed and bound in a manner appropriate to a work of reference.

The Chemistry of Drugs

By N. Evers and D. Caldwell. 3rd edn. Benn, London. Pp. 415. 84s. net.

ANYONE who tries to summarise current knowledge of the chemistry of drugs in a single volume faces a formidable task of compression. In a work running to just over 400 pages, Dr. Evers and Mr. Caldwell try to take the reader over a very long course. Their object is to cover the chemistry of both synthetic and natural drugs, their structure, methods of preparation and synthesis, as well as their chemical

properties and therapeutic uses. This is a much more daunting assignment than it was 33 years ago when Dr. Evers produced the first edition of this book.

The biggest problem must have been what to leave out. A comparison with the previous editions shows that many drugs have been omitted in favour of such classes as hormones, antibiotics and tranquillisers. But the authors' sense of balance must be questioned when it is noted that only 15 pages are given to antibiotics and only 32 to hormones. Against this there are 12 chapters on alkaloids comprising 78 pages.

The style of the book is terse and to the point and lavish use is made of structural formulæ. The book is well printed on good paper and it should withstand the constant handling which it will inevitably receive as a useful work of reference.

Steroids

By Louis Fieser and Mary Fieser. Reinhold and Chapman and Hall. Pp. 945. 144s. net.

THIS monumental American study of steroids evolved from *Natural Products related to Phenanthrene*, the third edition of which appeared in 1949. The two authors have done good work in summarising and clarifying a complex subject with an enormous literature. They write well and to the point.

There are 22 chapters, some of which are almost as long as a medium-size book. Chapter 19, adrenocortical hormones, for instance, takes 126 pages. The authors start with cholesterol and bile acids, continuing with vitamin D, enes and ols, ketones, sterols, methylsterols, bile acids and alcohols, œstrogens, androgens, progestogens, homo and nor steroids, adrenocortical hormones, cardiac-active principles, sapogenins and alkaloids. They range wide and deep over their subjects and have managed to bring their coverage up to March 1959, the book being published about six months later. This is a tribute to publishers and printers and it should be a lesson to British printers.

PLANT AND EQUIPMENT

►HYGROMETER

A hygrometer said to be capable of detecting 1 p.p.m. of water vapour in air or gas is available from Shaw Moisture Meters. The detecting element consists of a capacitor with a hygroscopic dielectric, with a 24 carat gold electrode. The variations in capacitance caused by the alteration of the moisture content are indicated on the dial of the hygrometer. The detector is contained in a fine wire gauze protector which plugs into a coaxial cable connecting it to the hygrometer. The detecting element is 1 cm. in dia. and 6 cm. long and can be used with any length of cable.

The instrument is stated to indicate 0-100% R.H., dewpoint to -100°C . and to have a temperature range of from -50°C . to 150°C . According to the manufacturers response is 1 sec.

►MULTI-PURPOSE MIXER

A general purpose laboratory mixer introduced by Silverson Machine (Sales) Ltd., consists basically of a centrifugal type suction pump enclosed in interchangeable heads and meshes. Rotor blades subject liquids to intense shear at high velocities, giving rapid and thorough processing. The manufacturers claim that emulsor meshes assist processing, break down agglomerates, remove oversize particles and produce homogeneous emulsions and dispersions rapidly.

The motor is enclosed in a chromium-plated casing together with a rheostat, controlled by a knob on top of the casing, and gives speeds of from 200 to 8,000 r.p.m. under load. A separate on/off switch is also fitted. All working parts are in stainless steel and the machine is said to be easy to clean. It can handle quantities from 8 fl. oz. to 2 gal., and a number of accessories are available, including an emulsor head, axial flow head and bench stand.

►ASH EXTRACTOR

The Riley automatic ash extractor has been developed as a standard item for installation with most sizes of Riley type "T" chain grate stokers.

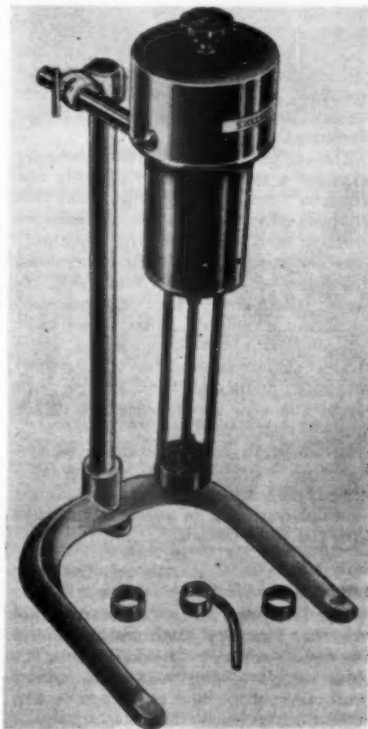
The extractor is a conveyor type, the ash being stationary on the apron plates and moving in relation to the conveyor, not in opposition to it as in the case of scraper and drag link conveyors. The conveyor travels at a constant speed of $3\frac{1}{2}$ in. per min. and is driven by a separate gear assembly comprising a $\frac{1}{2}$ h.p. geared motor with a reduction of 1440/0.96 r.p.m. and a further gear train with a 3 to 1 reduction, giving a front shaft speed of 0.32 r.p.m. A spring-loaded clutch with the

driven half on a splined shaft protects the gear assembly from overload. Provision is made for tensioning the conveyor.

A steam cleaning assembly, which, operated for about 15 sec. per week and which uses less than 1 lb. of steam in the process, is incorporated to remove any fine particles of ash which penetrate to the inside of the extractor. The ash box at the front of the stoker provides for an ash chute to a water trough conveyor, but it can be fitted with a draw-plate for discharging ash into a low trolley or pan with runners attached.

The advantage of an automatic ash extractor is that it eliminates the frequent opening of ash doors and thus prevents the ingress of air which cools the furnace gases and reduces efficiency. Forced draught fans do not have to be stopped while ashing is in progress.

In plants where automatic control is considered desirable, an ash extractor is the complement of a coal bunker or conveyor for charging the stoker hoppers.



High-speed multi-purpose laboratory mixer. Speeds can be varied from 200 to 8,000 r.p.m.

►AUTOMATIC INCINERATOR

The Barrywold automatic incinerator, marketed by Saniguard Appliances Ltd., has been designed to give a simple and trouble-free disposal service for used dressings, etc., in hospitals, sanitary towels, and for the destruction of legal and confidential documents. The incinerator consists basically of a combustion chamber with an electric heating element, a receiving tray so designed that no contact can be made with the combustion chamber when inserting articles, and an automatic time control.

Depression of a lever on the left side of the unit sets the automatic mechanism in operation by opening the outer and fumes covers, rotating the safety trap to the receiving position, clearing the combustion chamber of ash remaining from any previous insertion and by tilting the mercury vacuum switch which switches on the electrical components to begin the disposal action. These components consist of a sheathed element, signal indicator at front right of the cabinet and a time control unit which returns the mercury switch to its "off" position in 5/7 min., when the current is automatically cut out. With each depression of the lever the time control unit is reset to its starting position.

The combustion chamber is equipped with a 1 kW. element said to eliminate heat loss and ensure direct combustion. Each insertion requires approximately $\frac{1}{5}$ of a unit of electricity for disposal. This consumption is reduced when the incinerator is in continuous use. Ash is ejected from the combustion chamber automatically and the ash grill is so designed that no partially destroyed article can pass through into the ash container. The cabinet is finished in stoved cream enamel with fittings in black to contrast. A flue pipe is required and can be supplied at extra cost. Standard piping is 2½ in.

►DRUM CRYSTALLISER

A laboratory model rotary drum crystalliser, available from Kestner Evaporator and Engineering Co. Ltd., incorporates all the essential features of the full-scale model and is said to be particularly suitable for handling metallic salts such as sulphate of copper and nickel. Water cooling is used and the unit is completely self-contained.

In operation warm saturated liquor is fed into the drum at one end and flows slowly to the other end. Due to the rotation of the drum a thin film of



Electronic batch counter and bridging device for counting and packing bottle closures.

liquor is formed on the inside of the drum. Cooling water is supplied from the distributor and covers the outside of the drum in a thin film. To keep the inside surface of the drum free from crystal build-up a scraper chain is provided. Crystals and mother liquor overflow continuously from the outlet end of the drum where they can be filtered or centrifuged as required.

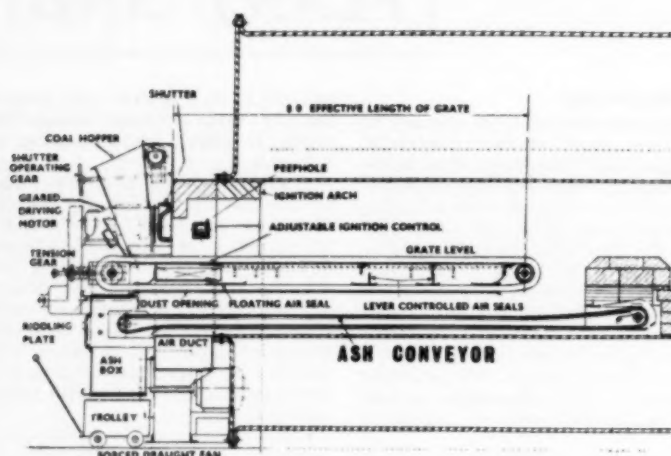
Care has been taken in the design of this model to provide the maximum flexibility in operating conditions. For example, the drum speed is infinitely variable over a range of 2 to 1 r.p.m. and alternative sprockets are provided which give a maximum speed of 20 r.p.m. and a minimum speed of 2 r.p.m. The angle of inclination of the drum is infinitely variable from 0 to 5° off the horizontal.

The drum is made of stainless steel and has a total cooling surface of 18 sq. ft. The scraper chain is also made of stainless steel and the position and tension of the chain can be adjusted over a wide range to suit individual requirements. Alternative types of scrapers are also available. The support frame is welded up from rolled steel members and the cooling water distributor pipe and collecting trough are of galvanised steel.

The drive is provided from a $\frac{3}{4}$ h.p. variable speed motor through chain and sprocket to the drum itself. The drum is mounted in two machined cast iron tyres each of which rotate in two cast iron rollers which are provided with adjusting screws and Stauffer lubricators.

The overall dimensions are: Length 7 ft. 6 in., width 2 ft. 11 in., height 3 ft. 6 in.

RILEY CHAIN GRATE STOKER WITH ASH EXTRACTION



Chain grate stoker with ash extraction. A steam cleaning assembly is incorporated to remove fine particles of ash.

►COUNTING AND PACKING CAPS

A new approach to the problem of counting and packing caps and closures has been made by Roberts' Capsule Stopper Co. Ltd. Two cartons or boxes are placed side by side beneath a delivery chute which consists of an electronically operated "bridging" device.

Caps or stoppers pass through a light beam between the photo-cell and light heads of a B.C.A. electronic batch-counter made by the Electronic Machine Co. Ltd.

The output from this batch-counter operates a stepping relay directly the required "batch" is reached and this stepping relay then energises a solenoid which in turn pulls down the "bridge," thus diverting the flow to the second container—the now full one being replaced by an empty one. The solenoid remains energised until the next "batch" is reached, when the same process takes place on the other solenoid, thus causing the "bridge" to divert the flow in its original direction.

In addition to the control of the diverting "bridge" the counter also records the total number of batches handled during a production run and thus the total output.

►HIGH SPEED TABLETING

The Rotapress rotary tablet machine, made by Manesty Machines Ltd., is of the double rotary type and is offered in three series giving maximum tablet diameters of $\frac{1}{8}$ in., $\frac{1}{4}$ in. and 1 in., maximum possible tablet outputs of 5,280, 4,320 and 3,552 per min. and pressures of 6½ and 10 tons.

Features of construction include generated cam tracks to ease the

machine and tool loadings and, in order to facilitate high speed tableting, three sets of cams are supplied with each machine to cater for ranges in filling depths being used.

The stainless steel hoppers are fitted with cut-off slides and powder sights with adjustments to enable the powder flow to be regulated. Height of the machine to the top of the hopper is 5 ft. 4 in., dust extraction nozzles are fitted at the pressure points and when working the machine is totally enclosed, transparent plastic guards enclosing the turrets.

The top punch can be set by a graduated scale to give adjustable penetrations in the die, a desirable feature when using tapered dies or compressing difficult materials. A special rotary feed unit is used which is said to not only permit high-speed operation, but to make the dieplate practically free of powder. The machine is mounted on anti-vibration mountings.

An overload release operates on upper and lower punches. It is said to give improved protection against double fills and to enable tablets to be made of constant density when varying fills are experienced. The design of this overload mechanism is such that the maximum build-up due to the machine overloading represents a small percentage of the total load. The upper and lower pressure rolls are both adjustable, thus enabling the tablet to be made in any position in the die, and the adjusting sleeves are graduated for matched setting.

The Rotapress can be adapted for the production of multi-layer tablets. The manufacturers recommend that dust extraction equipment be used with the machine.

NEWS . . .

Chemical plant makers' dinner

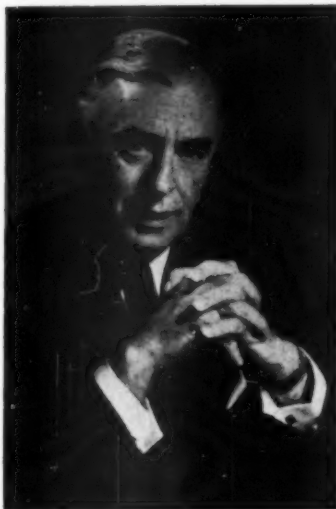
Chemical industry should have closer ties with plant manufacturers

Call for fewer and bigger contractors

CLOSER partnership between chemical plant manufacturers and the chemical industry was urged by Mr. H. W. Fender, chairman of the British Chemical Plant Manufacturers Association, at their annual dinner in London on October 28. Well over 800 members and guests, at least 100 more than ever before, attended the dinner. Among the guests were customers from France, Russia, the U.S., Mexico and Japan.

Mr. Fender regretted that the chemical industry seldom used the plant industry as main contractors and pointed out that the industry now had the technical facilities to do much more than supply individual items of plant. By bringing in the plant manufacturer at the inception of new projects, said Mr. Fender, customers could have plants on stream more quickly than otherwise. Closer partnership was especially important in selling processes overseas. The British chemical plant manufacturer was being prevented from tackling a number of projects, particularly for Russia, because they lacked the know-how. Collaboration between the two industries could overcome this and ensure that when British know-how was sold to foreign customers, British plant would be sold at the same time.

These points were taken up by the principal guest, Sir Walter Worboys, who has just retired from the position of commercial director of I.C.I. after 34 years' service with the company. In his view only 10% of the B.C.P.M.A. membership of 245 firms were chemical plant manufacturers in the sense that they could offer complete plants. The others were plant equipment manufacturers. "In saying this," said Sir Walter, "I do not wish to belittle the rest of your members because the effectiveness of a plant is determined by the effectiveness of individual items of equipment." He thought that the industry could realise the ambitions outlined by Mr. Fender if there were fewer and bigger firms able to do the necessary research and development work. He conceded, however, that it was not only plant manufacturers who had to make new efforts. "The



Sir Walter Worboys.

chemical manufacturer must also make an effort, in particular he must try to overcome the habits of secrecy that have become deeply engrained. Some information must be kept secret, but in my opinion there is a mass of information and experience which is really non-confidential and which would benefit our industries as a whole if it could be made generally available."

But however successfully a partnership could be developed, in Sir Walter's view chemical manufacturers could not afford to disband their engineering and design departments. "It is the chemical manufacturer who decides whether or not to invest in plant for the manufacture of a new chemical and in making his decision he will want expert engineering advice." Such advice would have to come from his own engineers, particularly in the case of new production where it was vital to observe secrecy.

However, there was no doubt that the two industries were interdependent and Sir Walter endorsed Mr. Fender's opinion of the advantages that could flow from closer partnership, particu-

larly when selling processes and plants abroad. A stronger chemical plant industry could be the repository of a vast amount of plant operating experience which would be invaluable if made generally available. It was the chemical industry's duty to shed its obsession with secrecy and the plant manufacturer's duty to keep in close touch with his customers and ensure, for instance, that he gave them good after-sales service.

Wellcome trust grants

Grants made by the Wellcome Trust during the period ending August 31, 1959, totalled over £400,000. They included a grant of up to £3,600 to the Worshipful Society of Apothecaries to establish a research fellowship in the history of medicine and pharmacy.

Sir Alexander's rocket

Tory victory should be used to improve industrial relations

Speaking on November 5 at the Institute of Directors annual conference, Sir Alexander Fleck, chairman of I.C.I., let off what he called a "little rocket." "Guy Fawkes day celebrates the failure of a widely disliked plot. No one . . . should deny us the joy of celebrating the failure last month, in the shape of extended nationalisation plans, of another . . . widely disliked plot."

Sir Alexander urged his audience to regard the victory of the Conservatives in the general election as a chance to improve industrial relations which, he said, were not nearly so good as they might be. As industry became bigger it was difficult not to think in terms of monolithic groups. But these groups were men and women and should be thought of as such, even if it cost money for personnel work. Individual contact at all levels was paramount. I.C.I. thought their Works Council system to be successful but they had not yet found a corresponding framework for direct contact between top management and the junior staff in laboratories and offices.

Sir Alexander expressed his belief in profit-sharing and co-partnership. The fact that many I.C.I. people held on to the shares they acquired under the company scheme showed that factory people appreciated that profit-sharing and co-partnership formed a consistent whole.

Looking to the future, I.C.I.'s chairman foresaw a time when the artificial differences between office and factory workers would disappear. It was wrong that a white collar worker should have privileges denied a man who looked after intricate and valuable machinery.

Pharmaceutical services in Northern Ireland

A survey of health and welfare services in Northern Ireland notes that in recent years the calls upon the pharmaceutical services have increased almost without interruption since 1948. Over 4,686,000 prescription forms were dispensed in the financial year ended March 31, 1958, and the total cost of the pharmaceutical services, including payments by patients and to dispensing doctors, in that year was £2,425,000. The comparable figures for the year ended March 31, 1950, the first complete financial year, were 4,334,000 forms and £1,275,000.

On General Health Services (general medical, dental, pharmaceutical and eye services) expenditure per head in Northern Ireland exceeded that in Great Britain, the figures being 77s. 7d. and 71s. 4d. respectively. The excess in Northern Ireland was mainly accounted for by higher expenditure on pharmaceutical services, offset to some degree by slightly lower expenditure on general dental services.

The report appears in *Ulster Year Book 1957-58* (H.M.S.O., 6s. 6d. net).

Drug trade barriers studied

For the first time, a survey is being carried out of regulations hampering international trade in pharmaceutical products, with the object of an eventual reduction or abolition of these obstacles. At a recent meeting of the O.E.E.C. Chemical Products Committee, which is undertaking this work, information already supplied by Member countries on their own regulations was studied, and it was decided to ask for further information to enable a complete picture to be formed.

Enough has already been learnt to show that these regulations vary widely from country to country. Some are concerned with import restrictions such as licences, permits and taxes. Others include the limitation of types of establishment permitted to sell pharmaceuticals, price control, and the existence of lists of prescribable medicaments under health insurance schemes.

In providing the information required to complete this survey, Member countries have been asked to list the difficulties encountered by their own manufacturers and exporters in introducing their products into other countries.

On completion of their survey, the Chemical Products Committee will consider what steps can be proposed to eliminate as far as possible the existing handicaps to trade.

The Committee elected M. E. Lombardi, of Italy, as its Chairman for the coming year, and M. E. Ganzoni, of Switzerland, and M. A. Rougé, of France, as its Vice-Chairmen.

People

D. K. Fraser, at present managing director of Petters Ltd. of Staines, will be joining the board of G. A. Harvey and Co. (London) Ltd. in the near future.

G. H. Black, joint managing director of the Kestner Evaporator and Engineering Co. Ltd., is visiting America and Australia. The first week of the trip will be spent in America and the following month in Australia. Mr. Black is a director of Kestner Australia Pty. Ltd., and accordingly will attach himself to the Sydney office. He will be travelling about Australia widely in that time.

P. F. Mangan has relinquished the position of advertising manager, Joseph Crosfield and Sons Ltd., chemical department, on being appointed to the advertising department of Unilever Export Ltd.; he is succeeded by **H. C. Nicholls**.

Dr. K. J. Lynes, works and production director of Pfizer Ltd., has been appointed a director of their subsidiary, Kembell, Bishop and Co. Ltd. Dr. Lynes joined Pfizer in 1954 as fermentation supervisor. He was appointed a director in October 1958. A native of Coventry, he graduated as a B.Sc. at Birmingham University in 1941 and took a Ph.D. in 1948. He joined the research and development department of The Distillers Co. Ltd., and from 1949 to 1954 was in the fermentation department of Glaxo Laboratories.

The executive directors of Kembell, Bishop are **W. W. Muir** and **R. F. Kembell**, joint managing directors, and **F. G. Hart**, finance director.

R. W. Ramsay, director and general manager of Evans Chemicals Ltd. and Biometica Ltd., has left for New York to visit the principals of American associated companies and other contacts. During his stay there he will study American methods of manufacture and marketing of products of particular interest to the British associated companies.

J. L. Caldwell has been appointed a director of Reads Ltd. He is chairman of the Merseyside branch of the Institution of Works Managers.

British Schering Ltd. have retained as advisory pharmacologist **Walter A. Broom**, formerly head of the biology division of Boots Pure Drug Co., who, since his retirement from that position, intends to act as an independent consultant in pharmacology and biological standardisation.

William J. Lloyd has been appointed managing director of the group of companies comprising William R. Warner and Co. Ltd., Richard Hudnut Ltd. and the Lambert Chemical Co. Ltd. Mr. Lloyd has resigned as a director of Aspro-Nicholas Ltd., in charge of home and overseas operations, in order to take up this appointment.

S. R. Mansfield has been appointed chairman and joint managing director and **K. Bohemen**, deputy chairman and joint managing director of Polak and Schwarz (England) Ltd. In addition, **J. Pickthall**, F.R.I.C., and **R. A. S. Lacey**, A.R.I.C., who have been members of the staff for some years, have been appointed directors of the company.

Mr. Pickthall, who joined the company in 1947, is chief chemist and perfumer and an author and lecturer. He is a past president of the Society of Cosmetic Chemists.

Mr. Lacey joined the company in 1948 and has been in charge of development work. The factory at Haverhill for the manufacture of fine chemicals was planned by him and the equipment of advanced design installed there is the result of investigations carried out by his department.

G. W. Atkinson, manager of Shell Chemical's Egham technical service laboratories since February 1957, has been appointed area co-ordinator, North Europe, with Bataafse Internationale Chemie at the Hague. The new manager at Egham will be **Dr. E. S. Paice**, at present assistant manager of Koninklijke/Shell Plastics Laboratorium, Delft. He is expected to take up his appointment on December 1. Dr. Paice was head of plastics and resins department, Shell Chemical Co., until January 1958.

Dr. F. P. Hiron, head of the resins laboratory at Egham, has been appointed deputy to the manager in addition to his existing duties.

E. E. Bullen has been elected to the board of the Shell Chemical Co. Ltd. as finance director. He was formerly finance manager. Mr. Bullen joined the Royal Dutch/Shell Group in 1930. He served in Morocco as chief accountant from 1931-1941 and the following year was awarded the M.B.E. for his services with the underground movement in Morocco. He was chief accountant for the Shell Co. in West Africa from 1942 to 1946 and then returned to the Shell Petroleum Co. in London. He was appointed finance manager of Shell Chemical Co. in April this year.

G. F. Harrison of Wallington, Surrey, has left Chas. Page and Co. Ltd. He joined the company in 1916 and was appointed a director in 1947.

At the annual general meeting of the Fertiliser Manufacturers' Association held recently, **Humphrey G. Rope**, Fisons Ltd., was elected president, and **R. B. Risk**, the Farmers' Co. Ltd., vice-president, for the year commencing October 1.

Sir Ian Jacob is to join the board of Fisons from January 4 next. Sir Ian has been Director-General of the B.B.C. since December 1952, and is retiring at the end of the year.

Mr. R. E. Eckton, M.A., technical service manager of Givaudan and Co. Ltd., Whyteleafe, will be visiting Givaudan-Delawanna Inc., New York in November. The world-wide Givaudan organisation encourages personal contacts of this kind to ensure that their customers get good service wherever they may be.

C. B. Bolland has been appointed a director of Laporte Acids Ltd., the Sheffield Chemical Co. Ltd. and James Wilkinson and Son Ltd. He has relinquished his appointment as a director of Laporte Chemicals Ltd.

B. H. Oldfield and **E. O. Rounsefell** have been appointed directors of Laporte Chemicals Ltd., and **S. N. Barford** has been appointed raw materials buyer at the company's Luton works in succession to the late Mr. R. S. Harden.

F. E. Shoninger, managing director of Antoine Chiris Ltd., and president of Antoine Chiris Corporation in New York, has just returned to the U.S. after his quarterly visit to the British company. Sailing with him on the S.S. *Queen Mary* was **John G. Meredith**, director of sales of the British Chiris company, who is paying his first visit to the United States.

The principal reason for Mr. Meredith's visit is to develop closer co-ordination between the two companies, particularly in regard to the servicing of the many important U.S. companies who are expanding their operations in the United Kingdom. Whilst in the United States Mr. Meredith will also examine the possibilities of extending the sale in the United Kingdom of the American essential oils, such as spearmint, peppermint and cedarwood.

The various Chiris companies were among the first manufacturers of essential oils and aromatic products to organise laboratories and manufacturing plants throughout the world. Aside from the French company, Antoine Chiris has U.K. and U.S. companies, and more recently has organised manufacturing concerns in Brazil and in the Argentine.

A. W. Morrison B.Sc., has been appointed sales director and a member of the board of Ciba Laboratories Ltd., Horsham.

Mr. Morrison was educated at Ayr Academy and Glasgow University. Under the Allied Control Commission, he helped in the reactivation of the pharmaceutical and other chemical firms in Germany after the war. He has also held appointments in the D.S.I.R.

W. W. Nicholas, Midland representative of Walker, Crossweller and Co. Ltd., has left the company to take up a teaching appointment at Birmingham Technical College. He is succeeded by **E. W. Tinsley**.

Two new appointments have been made by John and E. Sturge Ltd. to cope with increasing sales. **G. J. Holliday** has been appointed to the new position of sales supervisor for the Greater London area and will deal mainly with the food, soft drinks and pharmaceutical industries. **L. R. Tomlinson** has joined the company from Allied Colloids Ltd. as a technical sales representative. He will be based at Birmingham and have special responsibility for the rubber, plastics, paint, printing ink and paper industries.

L. Schepers, a managing director of the Royal Dutch/Shell Group of Companies, has been appointed chairman of Shell Chemical Company in succession to **F. A. C. Guepin**, who retired in June. Born in September 1903, Mr. Schepers studied at Delft Technical University and entered the service of Shell in October 1926, when he took up an appointment with Astra Romana in Roumania. He subsequently served in Indonesia, Argentina, Venezuela and Netherlands New Guinea. He was in the Far East at the time of the Japanese invasion and was interned from 1942 to 1945. After the war Mr. Schepers resumed his duties in Indonesia and then had assignments in the United States and Venezuela where he remained until taking up an important position in Bataafse Petroleum as head of production department in January 1951. A year later he became a managing director of the Royal Dutch/Shell Group.

N. R. Kirby has been appointed general sales manager of Croda Ltd. He joined the company 20 years ago as a laboratory assistant, and has for the past few years been their chief technical representative in the Sheffield area. **R. J. Seddon** has been appointed representative in the Sheffield area.



A. W. Morrison.

Obituary

Sir Henry Tizard, F.R.S., died on October 9 aged 74. He had a long connection with aeronautical science and for a short time in the 1920's he was secretary of the D.S.I.R. In 1946 he was made chairman of the Advisory Council on Scientific Policy and of the Defence Research Policy Committee. In 1952 he began a connection with the chemical industry, becoming a director of Glaxo, Albright and Wilson, Marchon Products, Solway Chemicals, and Blaw Knox.

New standards for test tubes and pH meters

First published in 1935, British Standard (B.S. 625: 1959, bacteriological and agglutination test tubes) has now been revised—chiefly because manufacturers found that some of the tolerances in the first edition were unnecessarily restrictive.

Certain relaxations have been made to the tolerances in this edition, and five sizes of tube have been added.

An important feature of the 8-page standard is the inclusion of requirements for a test for free alkali. This provides for tubes which comply with all the other requirements of the standard to be divided into two grades, according to whether they pass the test or not. The special grade is suitable where alkali leached from the glass must be kept to a minimum because it might affect the results of the work.

Another new Standard, for laboratory potentiometric pH meters (B.S. 3145: 1959), specifies performance requirements for laboratory potentiometric pH meters. Its publication is particularly appropriate in view of the issue in recent years of standards for pH scale and for glass electrodes (B.S.s 1647 and 2586 respectively) and it will in due course be complemented by a specification for deflection pH meters.

Among the performance requirements specified in the standard are those for calibration of the scales, sensitivity, stability and input current. Other requirements in the 8-p. publication include those for the temperature compensating device, auxiliary pH control, connection to the glass electrode and for screening.

Copies of the Standards may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 3s. net.

Shell's new department

Shell Chemical Co. has formed a new department in their Agricultural Division—the commercial department. It has been created to separate the direction of sales effort from the formulation of commercial policy.

R. R. Chippindale, formerly head of chemicals section, Sales Department, is appointed manager of the new department.

Advice in pest control

A new centre for giving free advice on woodworm, dry rot and pest control has been opened at 16 Dover Street, London, W.1, by Woodworm and Dry Rot Control Ltd., of East Grinstead. This replaces an advisory centre opened nine years ago in Bedford Square, London. Provincial centres are located in Bournemouth, Birmingham, Belfast, Bristol, Edinburgh, Glasgow, Liverpool, Manchester, Newcastle and Nottingham.

The new premises in Dover Street have permanent exhibits, a lecture room and a cinema. Visitors may take away advisory leaflets concerning a large number of household and industrial pests, and the free identification services have been extended to cover the scores of ants, beetles, spiders, moths and other troublesome and destructive insects which may be found in this country.

At the research laboratory at Felcourt, East Grinstead, there is now a film unit making films which will be shown at Dover Street and elsewhere, and to which is now attached a field research unit for mobile studies of pest problems throughout the country.

The Director of the centre at Dover Street is Mr. S. R. Gauntlett who has been closely associated with pest control for 28 years.

Among those who will lecture at the centre will be Dr. Norman E. Hickin, an expert on timber decay, and Mr. Miles Price, a scientist who has been responsible for new developments in rodent and insect control.

Action on the Hinchcliffe report

Mr. J. P. Dodds, an undersecretary at the Ministry of Health, commented on the Hinchcliffe report of prescribing at the 12th annual conference of the Executive Councils' Association at Eastbourne last month. He said that agreement had been reached on the form of the proposed comprehensive prescribing manual, and copies of it should be in the hands of general practitioners and hospital doctors as soon as printing allowed.

The suggested expert investigation into pricing had been completed and on the basis of its findings full pricing was in the process of being introduced.

Further investigations into pricing were in progress and it was hoped that it would eventually be possible to improve on existing methods. A by-product of this would, it was hoped, be the production of better statistics.

Recommendations in the final report affecting medical training had been taken up with the medical schools, who had shown themselves very ready to respond. Those affecting the drug industry had been gone into with the Association of British Pharmaceutical Industry. One of the major proposals was that the appropriate professional bodies should collaborate in forming a Clinical

Trials Committee to organise clinical trials of new drugs and preparations and to interpret their results; and that these results should be made known to general practitioners and others concerned in a new journal to be sponsored by the professional bodies. Consultations on this were in progress with the professional bodies, including the B.M.A.

Another important recommendation was that for an experimental period of two years there should be a voluntary limitation of the amount of medicine prescribed on any one prescription, with exceptions in chronic and special cases. This recommendation had been discussed, along with others, with the B.M.A., and it might be expected that before long practitioners would be receiving a note dealing with this matter of quantities, and with a number of other recommendations.

Training the disabled

An appeal for £250,000 has been launched by Queen Elizabeth's Training College for the Disabled, Leatherhead Court, Surrey. Some 300 trainees yearly pass through the college. Training usually lasts six months and includes book-keeping, clerical work, draughtsmanship, engineering, etc. The college accepts trainees with any disability except total blindness and active tuberculosis.

Company finance

Net profit of Boots Pure Drug Co. Ltd. for the year 1958-59 amounted to £2,072,663 (£1,961,394). A final dividend on the ordinary shares of 10% less tax has been recommended.

THE CHEMICAL MARKET

Zinc Oxide Up; Aluminium Stearate Cheaper

LONDON.—Owing to pressure on space our full price list has been held over. Here are this month's changes: **Zinc oxide B.P.**, in 2-ton lots, is up by £6 10s. to £122 10s. per ton, while **aluminium stearate** (precipitate) in 1-ton lots has fallen by £4 16s. to £253 10s. per ton. Other increases are: **strychnine** alkaloid, hydrochloride and sulphate in 25 oz. lots, all of which have increased by 3s. 3d. to 11s. 3d. and 10s. 3d. per oz. respectively; **silver nitrate** in 500 g. lots which is up by 1½d. to 5s. 3½d. per oz.; **benzoin**, Sumatra spot, up by 10s. to £27 per cwt.; and **tragicanth** Nos. 1 and 2 both increased by £3 to £130 and £124 per cwt. respectively. **Citric acid B.P.** in 1 cwt. lots has decreased by £1 1s. 6d. to £9 18s. 6d. per cwt.; refined, deodorised **palm kernel oil** in 2-ton lots by £3 to £156 per ton, and refined, deodorised **palm oil** in 2-ton lots by £1 to £102 per ton.

MEETINGS

Society of Cosmetic Chemists

December 16. "Packaging and Package Testing," by G. L. Riddell. 7.30 p.m. Royal Society of Arts, John Adam St., London, W.C.2.

Society for Analytical Chemistry

December 17. "Kjeldahl Nitrogen Determinations" discussion, to be opened by R. A. Savidge and H. C. Wilkinson. 7 p.m. Technical College, Nottingham.

Royal Institute of Chemistry

December 2. "Ion Exchange Membranes and their Applications," by H. T. Hookway. 6.30 p.m. Battersea College of Technology, Battersea Park Rd., London, S.W.11.

Pharmaceutical Society

November 25. A joint meeting with the Society for Analytical Chemistry. "Assays for Capsicum, Lonchocarpus and Rauwolfia." 7.30 p.m. 17 Bloomsbury Square, London, W.C.1.

December 3. "Antifertility Substances," by H. Jackson, followed by a discussion with Prof. A. D. Macdonald in the chair. 7.30 p.m. 17 Bloomsbury Sq., London, W.C.1.

Institution of Chemical Engineers

December 8. "Chemical Engineering Problems in Hydrogen Peroxide Production," by W. R. Holmes. 6.30 p.m. Manchester College of Science and Technology, Jackson St., Manchester.

Society of Chemical Industry

December 1. "Oxidation of Organic Sulphides," by Dr. L. Bateman. 8 p.m. Chemistry Department, Queen's University, Stranmillis Rd., Belfast.

December 4. "Solubilisation with Amphiphilic Compounds," by Dr. P. A. Winsor. 6.30 p.m. Chemistry Department, the University, Manchester.

December 10. "Chemical Kinetics in Relation to Large-scale Production," by Prof. K. G. Denbigh. 8 p.m. University Union, Aberdeen.

December 11. "The Work of the Railway Chemist," by E. D. Henley. 7 p.m. University College, Cardiff.

December 14. "Structure and Properties of Some Inorganic Polymers," by N. L. Paddock. 7 p.m. Houldsworth School of Applied Science, University of Leeds.

December 16. "Chemical Reactions as Seen by Chemists and Chemical Engineers," by Prof. P. V. Danckwerts. 5.30 p.m. Chemistry Department, University College, Dublin.

December 18. "Some Aspects of Forensic Science," by Dr. F. E. Camps. 6.30 p.m. 15 Belgrave Sq., London, S.W.1.

News from Abroad

UNITED STATES

Lipstick colours banned

Seventeen coal tar colours, mostly used in lipsticks, have been banned from unrestricted use in cosmetics by the Food and Drug Administration. The order is being contested by the Toilet Goods Association, which says it has plenty of evidence that the amount of lipstick ingested by women is completely insignificant and harmless.

Awards for British chemists

The Franklin Institute of Philadelphia has awarded medals to the three British chemists who developed gas-liquid chromatography. They are Dr. R. L. M. Synge, F.R.S., of the Rowett Research Institute, Dr. A. J. P. Martin, F.R.S., a director of Abbotts-bury Laboratories, Elstree, and Dr. A. T. James of the National Institute for Medical Research.

Cosmetics award

Dr. William S. Gump, research associate of the Givaudan Corp. and its subsidiary Sindar Corp., has been chosen by the Society of Cosmetic Chemists to receive its 1959 medal award for his contributions to the "art and science of cosmetics."

Dr. Gump has been recognised as a leading contributor in the field of bacteriostatic agents for use in anti-septic cosmetics, soaps and pharmaceuticals. His work in this field over the last 20 years included the discovery of hexachlorophene, and led to the development of other anti-bacterial substances. He and his co-workers have also contributed to the understanding of the mechanism of the deodorant action of anti-bacterial agents.

New research building

Construction is to start on the building to house the Union Carbide Research Institute, a special research activity of Union Carbide Corp. It will be situated at the company's Westchester County 280-acre property at Eastview, near Tarrytown, New York, and will be completed and ready for occupation in the latter part of 1960. On the same site a technical service laboratory for chemicals is nearing completion.

Union Carbide Research Institute was formed in 1956 in order to complement and extend the scope of the basic research being carried on in Union Carbide's research laboratories. Programmes already under way or in the planning stage include study of solid-state physics, the theory of metal bonds, and the structure of plastics. A substantial programme of biochemical research is also included.

A specific example of the project to be undertaken is one which will emphasise theoretical and experimental studies on the fundamental physical and chemical principles affecting high-temperature materials.

Aluminium aspirin

Anderson Chemical Co., Division of Stauffer Chemical Co., has completed construction of a new unit at its Weston, Michigan, plant for the commercial production of aluminium acetylsalicylate, or, as it is commonly termed, aluminium aspirin. Output is being sold to pharmaceutical firms as the basic ingredient of self-buffering analgesics.

An advantage of aluminium aspirin is its non-acidity. It can be incorporated directly into multi-ingredient tablets because it does not react with many other medicinal agents. It has been approved for adoption in the National Formulary. Aluminium aspirin has been made in the U.K. for the last three years. Manufacturers are Howards of Ilford Ltd., and Monsanto Chemicals.

AUSTRALIA

Cyanamid's plans

Cyanamid International, a division of the American Cyanamid Co., is considering plans for the production in Australia of pharmaceutical and speciality chemicals. These plans are part of a \$13 million expansion programme of the company. Already a local subsidiary, Cyanamid—Australia—Pty. Ltd., manufactures surgical sutures and tennis gut at Hurstville, New South Wales.

Shulton products to be made

Shulton (Great Britain) Ltd., manufacturers of Old Spice toilet preparations for men, announces that these will in future be made in Australia under licence by Riley-Williams Pty. Ltd. Previously these lines have been available in Australia in limited quantities only.

Pain reliever

"Seven out of 65 patients treated with an extract from the West Australian native plant *scaveola spinescens* said that their pain had been eased and their sense of well-being enhanced," says Minister Griffith of the W.A. Legislative Council. "It is thought that the extract may have produced some effects," he adds, "although some of the patients had received other treatment which could have produced the same results." The Wellcome Foundation is investigating the extract.

FRANCE

Du Pont weedkillers

A new company, Du Pont de Nemours (France) S.A., has been formed to contract for the manufacture of weedkillers in the expanding French market.

The company, a wholly owned subsidiary of the parent company, will sell *Telvar* monuron and *Karmex* diuron weedkillers for use in industrial and agricultural weed control.

ISRAEL

New antibiotic

An investigation, launched some four years ago by scientists of the Hebrew University, Jerusalem, has accidentally led to the discovery of a streptomycetes said to have strong antibiotic properties, and a new antibiotic against yeasts and fungi, *Heptamycin*, has been developed which was found to be effective not only *in vitro* but also *in vivo*.

Current investigations by the Bacteriological Department of the University are aimed at discovering whether heptamycin can be prepared in reasonable quantities commercially. It is also intended to establish its therapeutic index. Clinical tests, assisted by the Jerusalem firm of Teva Pharmaceutical Works Ltd., will be carried out on human patients as soon as these first investigations are completed.

HUNGARY

Chemical production to double

Hungary's chemical industry must double its output by 1965, according to a report issued in Budapest outlining the main aims of the country's second five-year plan (1961-65).

One of the key questions in the development of Hungarian national economy, says the report, is the vast development of the chemical industry. Artificial fertilisers and other chemicals are required to increase agricultural yields. Home and foreign requirements for medicines are growing quickly. Industry and the building industry also require chemicals to a greater extent.

Production of nitrogenous fertiliser must be increased four to five fold. Besides building the Tiszapalkonya artificial fertiliser factory, with an annual capacity of 82,000 tons, the capacity of the nitrogenous artificial fertiliser plant of the Borsod Chemical Combine (Kazincbarcika) must be doubled. Production of superphosphate, says the report, must be increased from 200,000 tons (1958) to 650,000 tons (1965).

New Products

Hypnotic/analgesic

The Distillers Co. (Biochemicals) Ltd. have introduced *Valgis*, a new hypnotic/analgesic in tablet form. It is a combination of *Distaval* (thalidomide) with aspirin and phenacetin for administration at night to relieve pain and give restful sleep. Each tablet contains *Distaval* 50 mg., aspirin 250 mg. (4 gr.) and phenacetin 250 mg. (4 gr.)

A tube of 12 tablets retails at 4s. 6d. Trade price is 3s.

Treating diarrhoea

A product from Smith Kline and French Laboratories Ltd., *Furozone*, is stated to eradicate many species and strains of Gram-negative and Gram-positive pathogens, particularly those causing diarrhoea. It is claimed that bacterial resistance is seldom developed and that cross-resistance is not acquired by bacteria which develop resistance to antibiotics or sulphonamides.

Furozone is available in 100 mg. tablets, and as a suspension containing *Furozone*, kaolin and pectin. Dosage is 1 tablet, or 1 tablespoon of the suspension, four times daily. The product is said to have low toxicity.

For the treatment of vomiting due to such causes as pregnancy and gastro-enteritis the company has developed *Stelazine*. This is said to give control of symptoms even in severe vomiting, quick response to low dosage and prolonged antiemetic activity. Available in 1 mg. tablets and 1 ml. ampoules, the dosage is 2-4 mg. daily. The ampoules are for intramuscular injection and give rapid control of symptoms.

Iso-decanoic acid

Commercial quantities of iso-decanoic acid (mixed isomers), a new organic product, are available from the Chemicals Department, Union Carbide International Co. The acid is a mixture of methyl-substituted, ten-carbon, aliphatic, monocarboxylic acids having relatively little α substitution. The principal isomers are trimethylheptanoic and dimethyloctanoic acids.

The acid has a high boiling point and is soluble in organic solvents but not in water. It will react to form salts, esters, amides, amines, etc. It has potential applications similar to those of coconut fatty acids (caprylic, capric and lauric) and tall oil-derived fatty acid (pelargonic). Being a primary product, iso-decanoic acid (mixed isomers) is said to be free from fluctuating supply and price.

Potential applications for the acid or its derivatives are: driers for varnishes and enamels, plasticisers and

stabilisers for polyvinyl chloride resins, alkyd resin modifiers for nitrocellulose automotive lacquers and alkyd-amine resin appliance finishes, boiler feed-water defoamers, synthetic lubricants for jet aircraft, functional fluids, fungicides, detergents, emulsifiers, corrosion inhibitors, flotation agents, oil additives and agricultural chemicals.

Anti-viral antibiotic

Helenine, an antibiotic derived by conventional fermentation methods from *Penicillium funiculosum*, has been found to prevent the development of polio in monkeys when administered before the symptoms appear. It has also protected mice against a form of encephalomyelitis and may be active against other viruses. Helenine has been characterised as a ribonucleoprotein, the same class of compound as the virus it combats. Unfortunately it is unstable and chemists at Merck Sharp and Dohme in the U.S. are trying to improve its stability.

It is found in the mycelium and is not exuded into the nutrient medium used to grow the mould.

Ulcer inhibitor

Carrageenin, a mucopolysaccharide extracted from seaweed, may have applications in the treatment of peptic ulcers. Experimental work has shown that the compound is equally effective in preventing the induction of ulcers by surgical ligation of the pylorus, by cortisone administration and by histamine. It is stated that carrageenin does not alter gastric pH, has no effect on the blood clotting mechanism, and is almost completely non-toxic.

According to Dr. J. C. Houck, of Georgetown University School of Medicine, Washington D.C., who carried out research on carrageenin, it apparently acts as a competitor of pepsin, moderating its proteolytic activity.

Persistent sulphonamide

I.C.I.'s Pharmaceutical Division have introduced *Bimez*. It contains sulphamethazine and sulphadimethoxypyrimidine in the proportion of 3:1, and is said to provide persistent sulphonamide blood levels which are maintained by single daily doses.

Bimez is available as tablets and a suspension. Tablets contain 0.375 g. of sulphamethazine and 0.125 g. of sulphadimethoxypyrimidine and are available in containers of 12, 50 and 500. Containers of 50 retail at 21s. each, trade price, 168s. per doz. *Bimez* suspension is available in bottles of 30 ml. and 1 teaspoonful is equivalent to 1 tablet. Bottles retail at 6s. each, trade price 48s. per doz.

Hypotensive

A long-acting drug, *Ismelin*, which is said to successfully control severe forms of hypertension with a single tablet daily, has been developed by Ciba Pharmaceutical Products Inc.

The product, which chemically is guanethidine, lowers blood pressure by reducing the body's stores of norepinephrine. It is not yet commercially available.

Treatment for colds

A new preparation for the treatment of colds has been formulated by the Chas. H. Phillips Chemical Co. Ltd. A two-layer tablet containing phenylephrine hydrochloride and paracetamol, *Coldrex* is claimed to diminish the symptoms of a cold, especially nasal congestion, if taken immediately at the onset. Dosage is two tablets at the onset of a cold, followed by one or two tablets every 4 hr. depending on the cold's severity.

The product does not contain aspirin or codeine and a high vitamin C content has been added.

The tablets, 12 in a box, retail at 3s.

Liquid seed dressing

A liquid seed dressing was the subject of a practical demonstration at Banbury recently, jointly organised by Shell Chemical Co. and Twyford Mill Ltd., who have been using the new liquid seed dressings for over three months with success.

It is claimed that the dressings will enable merchants to treat seed with complete accuracy and also to combine an insecticide with an efficient fungicide at one operation. The liquid insecticidal dressing is *Aster* which, for the control of wheat bulb fly, is used at the rate of 3 fl. oz. per bushel; for protection against wireworm attack a dressing of 1 fl. oz. is sufficient. The liquid fungicide is *Panogen*, an organomercurial compound for the control so such seed-borne diseases as bunt, smut, etc. Seed dressed with either product or a combination of both shows no adverse effect on germination.

Liquid dressings are said to have a number of advantages over powders. The "clogging" often experienced with powder dressings does not occur with liquids; nor is "over dressing" possible. They are also more pleasant to use. Both dressings contain a red dye to identify treated seed.

The machine used for dressing the seed, the model "A" seed treater, has been specially imported from Sweden. It can be hired by merchants from Shell Chemical Co., who also provide a complete maintenance service.

NEW TRADE MARKS

APPLICATIONS

Cosmetics, toilet preparations

CHRISTIAN DIOR.—762,602. *Parfumes Christian Dior.*
MISS DIOR.—762,604. *Parfumes Christian Dior.*
ROMAN HOLIDAY.—B783,109. *Bourjois Ltd.*
GIBBS CLINIC.—785,634. *D. and W. Gibbs Ltd.*
LYRIL.—786,761. *Hudson and Knight Ltd.*
"IONEX-B."—788,176. *Rafael De Leon Products Ltd.*
SYNTIL.—789,172. *Wellton Laboratories Ltd.*
DYLONETTE.—790,217. *Mayborn Products Ltd.*
SYCAMORE.—790,627. *Chanel Ltd.*
GALA OF LONDON.—783,841. *Gala of London Ltd.*
REVLON INTIMATE.—785,758. *Revlon Inc.*
"LIBERTY BRAND."—785,804. *Industrial Suppliers Cambridge (1958) Ltd.*
JANE SEYMOUR WONDER BASE.—B786,282. *Jane Seymour Ltd.*
BABYDARM.—786,472. *Mijnhardt Pharmaceutische & Chemische Fabrieken N.F.*
AUTOCRAT.—788,265. *M. E. A. King and G. H. P. Thomas.*
PLANET.—788,766. *Lincoln Hair Products Ltd.*
EXOTA.—783,499; LEGENDE.—783,501; OBSIDAN.—783,502; REFRAIN.—783,503; SANS SOUCI.—783,505. *Hans Schwarzkopf.*
TETE A TETE.—*Yardley and Co. Ltd.*
LANIMOL.—*Deb Chemical Proprietaries Ltd.*
PRINCE ARTCHIL GOURIELLI.—B747,863; GOURIELLI.—B747,864; PRINCE GOURIELLI.—B747,865; PRINCE GOURIELLI.—B747,866; GOURIELLI.—B747,867; PRINCE ARTCHIL GOURIELLI.—B747,868. *Prince Artchil Gourielli.*
SILKET.—B781,209. *Thames Industries Ltd.*
IMPERIAL GUARD.—783,927. *Cussons, Sons and Co. Ltd.*
DOMESTOS.—781,374. *Domestos Ltd.*
VENSTICK.—783,838. *William Pearson Ltd.*
GERARD.—779,372. *Gerard Bros. Ltd.*
BEAETHYS.—780,039. *Beaethys S.A.*
PANTENIL.—783,412. *Roche Products Ltd.*
IRGASAN.—783,561. *J. R. Geigy A.G.*
TINUVIN.—783,563. *J. R. Geigy A.G.*
GALA HEAVENLY PINK.—778,432. *Gala of London Ltd.*
ATKINSONS SKIN GLOW.—782,226. *J. and E. Atkinson Ltd.*
PLACELUM.—782,649. *Phyllis Scott-Lesley Ltd.*
SANSOUCI.—783,505. *Hans Schwarzkopf.*
MINER'S SHEER BEAUTY.—*Miners Make-up Ltd.*
ZALMA.—784,567. *Newton Chambers and Co. Ltd.*
"OLO."—778,792. *Woolf Price.*
CHYPRON.—781,833. *Les Parfums Chypron S.A.*
CHERI CHRISTIAN DIOR.—B781,966. *Parfums Christian Dior.*

Pharmaceuticals

COOMASSIE.—784,107. *Imperial Chemical Industries Ltd.*
DEXACORTISYL.—784,563. *Les Laboratoires Français de Chimiothérapie S.A.*
ALUMIL.—785,449. *Reheis Co. Inc.*
ETHIZYME.—785,656. *Ethicon Inc.*
AMPHOCCEL.—787,913. *Clarnell Ltd.*
PHYCEL.—787,914. *Clarnell Ltd.*
BROCILLIN.—788,056. *C. L. Bencard Ltd.*
CARALAX.—788,106. *Arthur H. Cox and Co. Ltd.*
BENEFLU.—788,431. *Roche Products Ltd.*
FLUPERIM.—788,432. *Roche Products Ltd.*
FLUPRIM.—788,433. *Roche Products Ltd.*
NEOSTOL.—788,465. *Anglo-French Drug Co. Ltd.*
ZARONTIN.—788,589. *Parke, Davis and Co. Ltd.*
FAMOTABS.—788,775. *Optrex Ltd.*
JUNIOR EX-LAX.—789,617. *Eslax Ltd.*
LANODERM.—789,915. *Agprolin Ltd.*
APAMYCIN.—789,955. *C. L. Bencard Ltd.*
CENTRIN.—790,068. *International Chemical Co. Ltd.*
ROBAXISAL.—790,087. *A. H. Robins Co. Ltd.*
ROVI-B.—790,131. *Roche Products Ltd.*
SOCOTIM.—790,579. *Société de Co-operation Technique et Industrielle.*
TWELVITIN.—790,597. *West Pharmaceutical Co. Ltd.*
COLIPAR.—790,604. *Union Chimique Belge S.A.*
AMPLITERRA.—791,320. *C. Pfizer and Co. Inc.*
APARGIT.—791,336. *Duncan, Flockhart and Co. Ltd.*
COMBREVIL.—791,337. *Duncan, Flockhart and Co. Ltd.*
ULTONE.—791,341. *D. F. O'Hare.*
CHAUVAX.—791,442. *Wellcome Foundation Ltd.*
DIQUINASYL.—791,740. *International Import and Export Corp. Ltd.*
CALCICOL.—779,490. *Tobal Products Inc.*
PARATROL.—780,300. *Duncan, Flockhart and Co. Ltd.*
GENATOCORT.—780,924. *Genatosan Ltd.*
VARIZYME.—B781,425. *American Cyanamid Co.*



"I GOT SOAKED COMING TO WORK THIS MORNING"

MEPROSAL.—783,588. *Wallace Manufacturing Chemists (Exports) Ltd.*
MYCINGUN.—783,770. *C. H. Boehringer Sohn.*
SAFF.—785,008. *Glaxo Laboratories Ltd.*
CERULYT.—785,482. *J. Rabinovitch.*
DIOTROXIN.—787,011. *Glaxo Laboratories Ltd.*
PRENC.—787,409. *Farbenfabriken Bayer A.G.*
FEBRINOL.—771,752. *Boots Pure Drug Co. Ltd.*
SURGISEL.—773,563. *Johnson and Johnson.*
DOMINA.—781,252. *Chas. Pfizer and Co. Inc.*
PARATEX.—781,659. *Gedeon Richter (Great Britain) Ltd.*
PANTESTIN.—781,661. *Gedeon Richter (Great Britain) Ltd.*
ALCSAL.—782,651. *Macleans Ltd.*
PERNEX.—783,151. *Reckitt Drug Co. Ltd.*
FIBRASE.—783,230. *Parke, Davis and Co. Ltd.*
PARADYS.—783,787. *West Pharmaceutical Co. Ltd.*
MAXAL.—783,827. *Macleans Ltd.*
TREMOL.—786,228. *National College of Health Ltd.*
STREPSILS.—786,232. *Boots Pure Drug Co. Ltd.*
NEO-ASMOTIL.—786,545. *Allied Laboratories Ltd.*
SYNOVEX.—774,762. *E. R. Squibb and Sons Ltd.*
OXOID.—775,546. *Oxo Ltd.*
RAMAVIT.—779,374. *Roche Products Ltd.*
PAXALGIN.—781,109. *Clinical Products Ltd.*
FELOGEN.—781,526. *Astaverke A.G.*
FERRADIN.—782,160. *Imperial Chemical Industries Ltd.*
OXYCAINE.—B782,936. *British Oxygen Gases Ltd.*
RISIZOL.—782,980. *Ravensberg G.m.b.H.*
SAFANS.—783,227. *Louis Maurice and Co. Ltd.*
EPILENE.—783,833. *Imperial Chemical Industries Ltd.*
LUVOS.—784,364. *Heilderde-Gesellschaft Luvos Just.*
GERIDEN.—785,014. *Denver Chemical Manufacturing Co.*
DI-NEOSTREP.—785,981. *Distillers Co. (Biochemicals) Ltd.*
DELTASSON.—786,173. *Ward, Casson Ltd.*
ASMAC.—787,150. *Dr. A. Wander S.A.*
FLUMIDIN.—787,474. *A/B Kabi.*
NUNCITAL.—787,475. *A/B Kabi.*
PENTERON.—788,110. *Imperial Chemical Industries Ltd.*
GRANOMAL.—783,428. *Imperial Chemical Industries Ltd.*
DELTA FENOX.—784,442. *Boots Pure Drug Co. Ltd.*
BISPANSINE.—785,631. *Riker Laboratories Ltd.*
WARPEL.—786,023. *Imperial Chemical Industries Ltd.*
VALGIS.—786,483. *Distillers Co. (Biochemicals) Ltd.*
ELESTOL.—786,660. *Farbenfabriken Bayer A.G.*
HELMOVIX.—778,001. *Imperial Chemical Industries Ltd.*
ENITHOL.—781,096. *Imperial Chemical Industries Ltd.*
AGEDAL.—780,642. *Farbenfabriken Bayer A.G.*

NEW PATENTS

COMPLETE SPECIFICATIONS
ACCEPTED

Detergents

Detergent compositions and salts used therein. *T. Hedley and Co. Ltd.* 823,653.

Antibiotics

Penicillin-sulphonamide tablets. *C. E. Frost and Co.* 823,914.

Antibiotic compositions containing novobiocin. *Merck and Co. Inc.* 824,785.

Weedkillers

Weed killing composition. *Montecatini Soc. Generale per l'Industria Mineraria e Chimica.* 824,557.

Agents for killing weeds and influencing plant growth. *Farbenfabriken Bayer A.G.* 824,534.

Vitamins

Nicotinic acid derivatives. *Nepera Chemical Co. Inc.* 820,169.

Process for the production of unsaturated compounds of the vitamin A series. *Farbenfabriken Bayer A.G.* 819,897.

Stabilized multivitamin compositions containing vitamin B₁₂. *Vitarine Co. Inc.* 822,127.

Steroids

Steroid compounds and method for manufacture of same. *Nepera Chemical Co. Inc.* 823,955.

Process for splitting steroid racemates. *Ciba Ltd.* 823,719.

Steroid compounds. *Merck and Co. Inc.* 823,940.

Steroids of the $\Delta^{1,4}$ -pregnadiene series and the preparation of $\Delta^{1,4}$ -pregnadienes. *American Cyanamid Co.* 824,351.

Steroid extraction. *Upjohn Co.* 824,151.

Process for preparing steroid compounds. *Merck and Co. Inc.* 824,348.

Dyestuffs

Water-insoluble azo dyestuffs containing urea or urethane groups. *Sandoz Ltd.* 824,443.

Polyazo dyestuffs containing triazole rings and their use. *J. R. Geigy A.G.* 824,327.

Metal complexes of dyestuffs of the benzene-azo-thionaphthene series. *Bad-*

ische Anilin- & Soda-Fabrik A.G. 824,300.

Dioxazine dyestuffs. *General Aniline and Film Corp.* 824,585.

Monoazo-benzoxathiol-5-dioxide dyestuffs and metal complexes thereof. *Farbenfabriken Bayer A.G.* 823,742.

Metallised monoazo dyes of the benzene-diphenylamine series. *Eastman Kodak Co.* 824,409.

Metallisable monoazo dyestuffs of the benzene-azo naphthalene series complex heavy metal compounds thereof, and their use. *J. R. Geigy A.G.* 823,945.

Cupriforous disazo-dyestuffs derived from 4:4'-diaminodiphenyl and process for their manufacture. *Ciba Ltd.* 824,284.

Benzene monoazo naphthylamine dyestuffs and the manufacture. *Ciba Ltd.* 824,171.

Monoazo-dyestuffs of the benzene-azo-benzene series and process for their manufacture. *Ciba Ltd.* 824,280.

Pharmaceuticals

Preparation of pteroylglutamic acid. *Kongo Kagaku Kabushiki Kaisha.* 823,827.

Isoseric acid and esters thereof and processes for their manufacture. *Ciba Ltd.* 823,707.

Anti-haemophilic globulin. *National Research Development Corp.* 824,483.

Alkaloid and process for manufacturing same. *Ciba Ltd.* 824,311.

Yohimbine derivatives and their preparation. *Ciba Ltd.* 824,097.

$\Delta^{1,4}$ - 16 - carbokoxy - 3 - epiallo - yohimbines. *Ciba Ltd.* 824,098.

Stabilised hyaluronidase. *Ortho Pharmaceutical Corp.* 824,290.

Pharmaceutical compositions containing 1 - methyl - 6 - nitro - 4 quinolene - 3 - carboxylic acid. *Imperial Chemical Industries Ltd.* 824,011.

Oral preparations. *Merck and Co. Inc.* 824,680.

Therapeutic composition. *Bristol Laboratories Inc.* 824,461.

Therapeutic tetracycline compositions. *Bristol Laboratories Inc.* 823,639.

Substituted 4-phenylpiperidine. *E. Lilly and Co.* 824,607.

Respiration-stimulant substances from blood. *Solco Basel A.G.* 824,375.

Alkaloid derivatives and methods of producing same. *K. Abildgaard.* 824,496.

Compounds having a spasmolytic effect. *Philips Glacilampfabrieken N.V.* 824,497.

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C.2.

M. Howell (Chemists) Ltd. 11.9.59. 94 William St., Ystrad, Rhondda. £2,000. Dir.: Maggie Howell.

Molecular Distillation Ltd. 11.9.59. Chemists, druggists, etc. £100. Sub.: B. T. Herbert, Acacia Hse., Westfield Terrace, Wakefield.

Compounding Ingredients Ltd. 23.9.59. 3 Chestow St., Manchester 1. Chemists. £600. Dir.: B. L. Tebbutt.

Fred Brabbing Ltd. 25.9.59. Chemists. £5,000. Perm. dir.: F. Brabbing, 4 The Parade, Blaenau, Chester.

A. W. Dobbs and Co. Ltd. 25.9.59. The Pharmacy, Hurstmonceux, Sussex. To take over the bus. of a chemist cd. on at Hurstmonceux by Arthur W. Dobbs, etc. £500. Dir.: A. W. Dobbs.

A. R. Cross (Waltham) Ltd. 15.9.59. 476 Hertford Rd., Enfield, Middx. To take over bus. of chemist lately cd. on by T. M. Hunnings at 91 High St., Waltham Cross. £7,000. Dir.: A. R. Cross.

Donald Pengelley Ltd. 16.9.59. Fore St., Looe. Consulting, analytical, mnfg., pharmaceutical and general chemists. £10,000. Dir.: D. B. Pengelley.

Walsall Chemicals Ltd. 17.9.59. Offices of Phipps (Packaging) Ltd., Middlemore Lane West, Redhouse Industrial Estate, Aldridge. £2,000. Dir.: D. P. Taylor.

P. Russell Read Ltd. 22.9.59. 132 High St., Hornchurch, Essex. Chemists. £7,500. Dir.: P. R. Read.

Charles Jenkins and Son (Bath) Ltd. 3.9.59. 86 Lower Bristol Rd., Bath. Chemists. £10,200. Dir.: C. L. G. Jenkins.

Stanmore Chemists Ltd. 3.9.59. 29-31 Euston Rd., London, N.W.1. £100. Dir.: Barnett Kitsberg.

J. C. Dewhurst Ltd. 7.9.59. 38 King St. West, Manchester 3. Chemists. £1,000. Dir.: J. C. Dewhurst.

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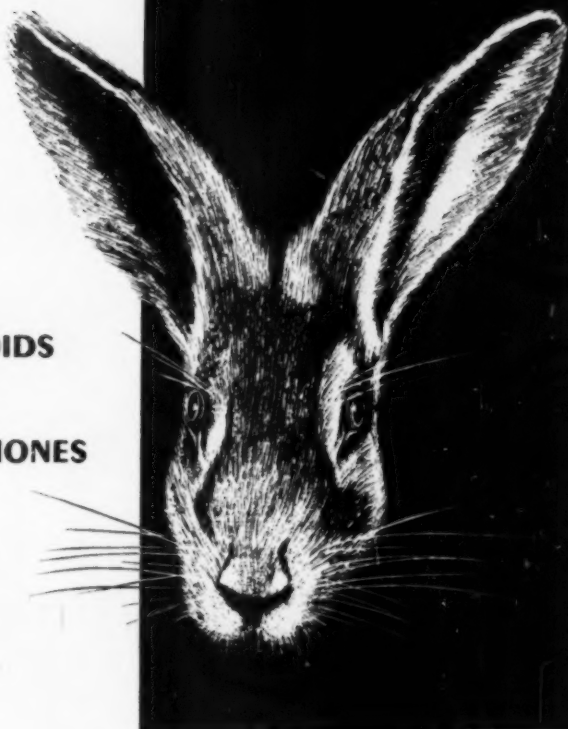
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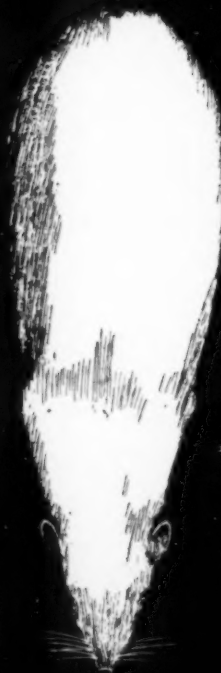
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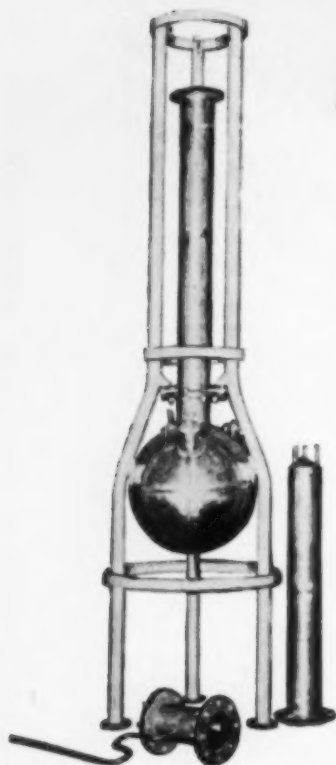
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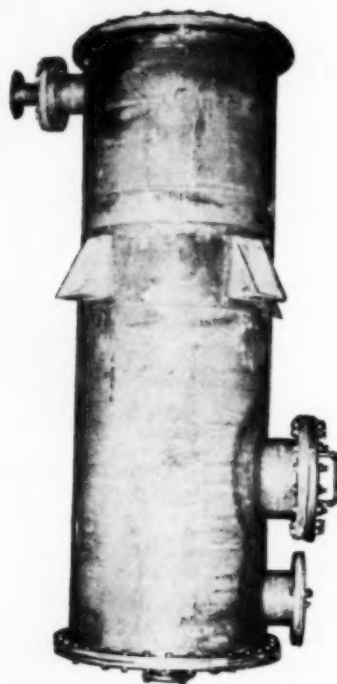
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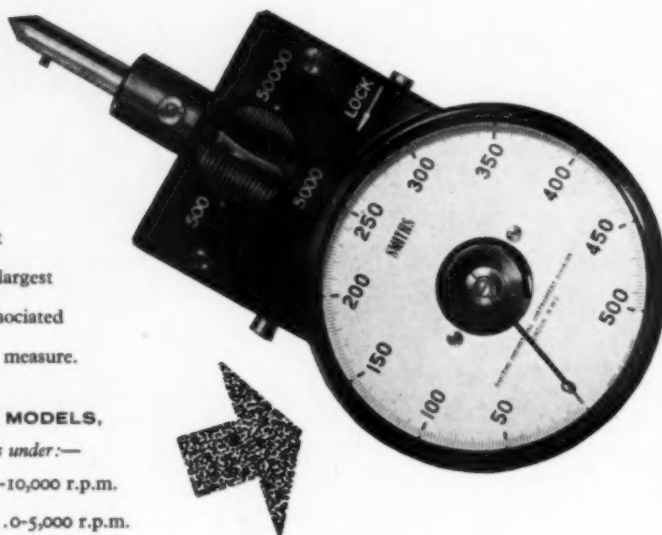
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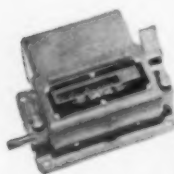
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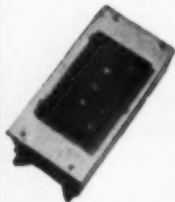
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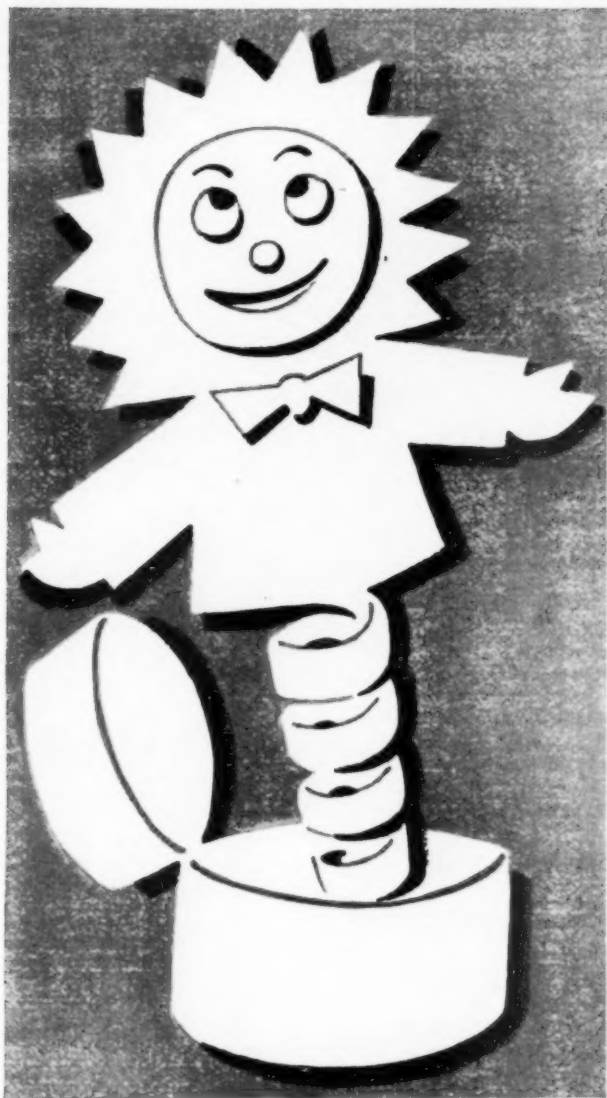
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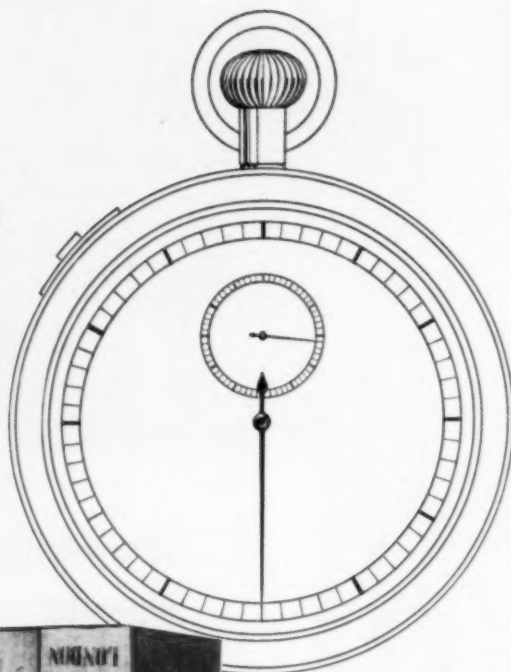
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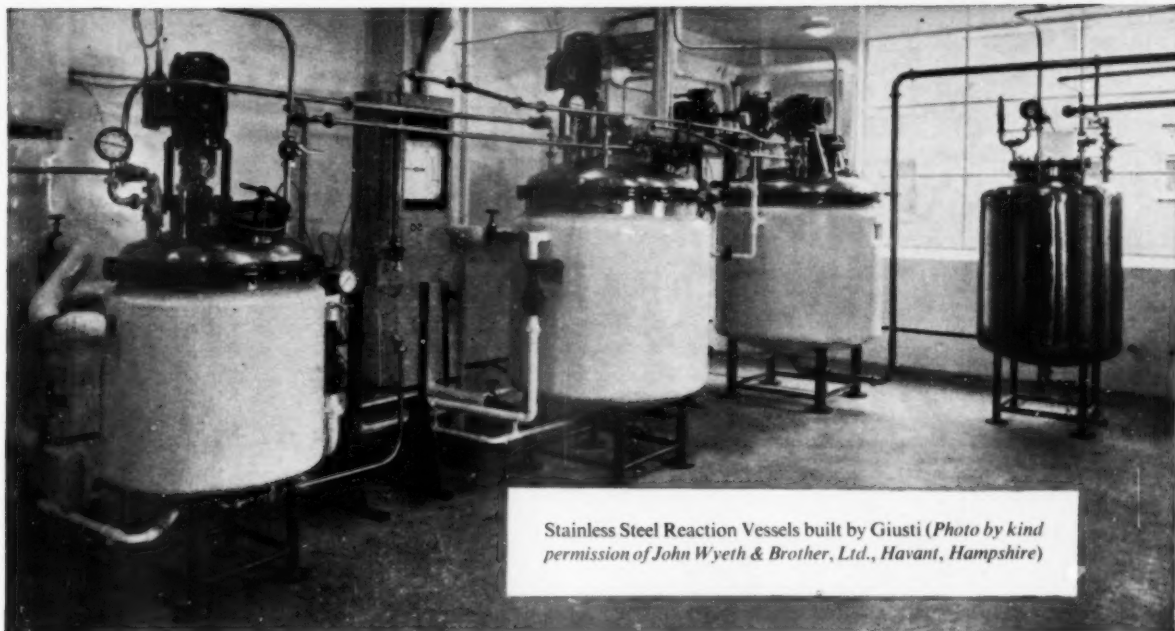
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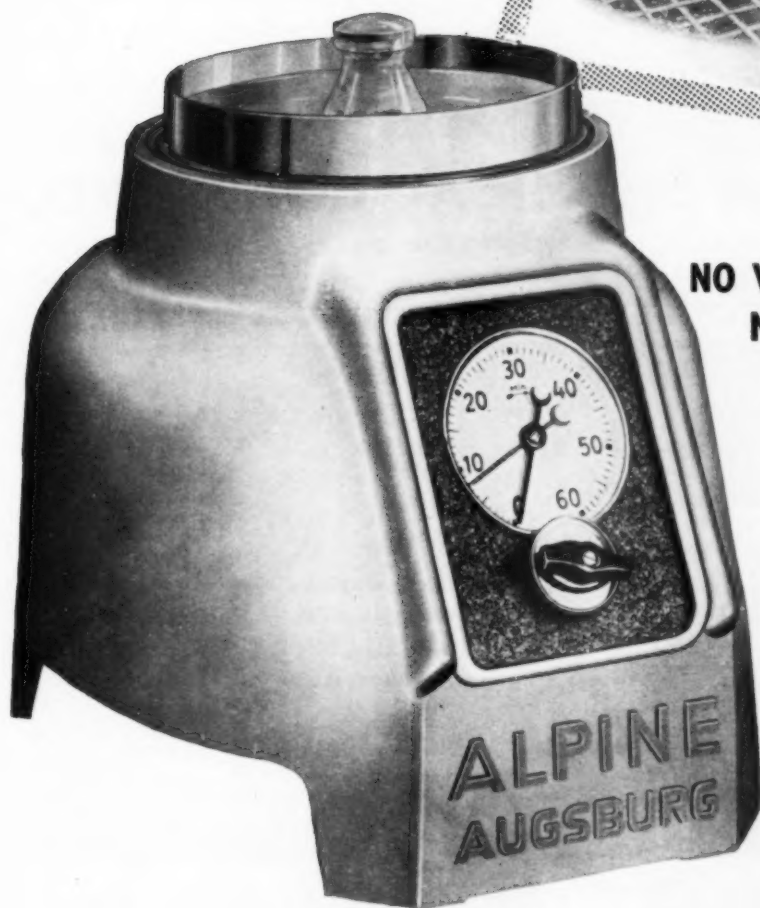
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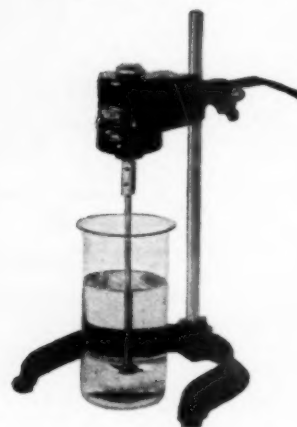
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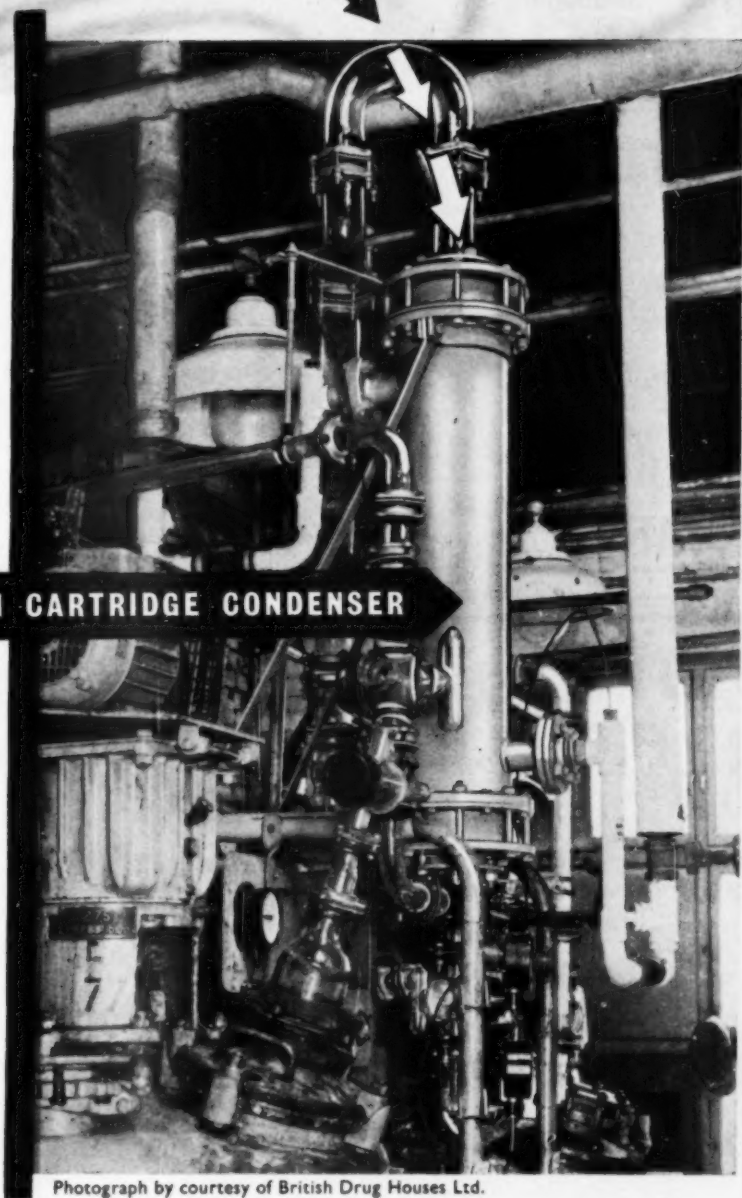
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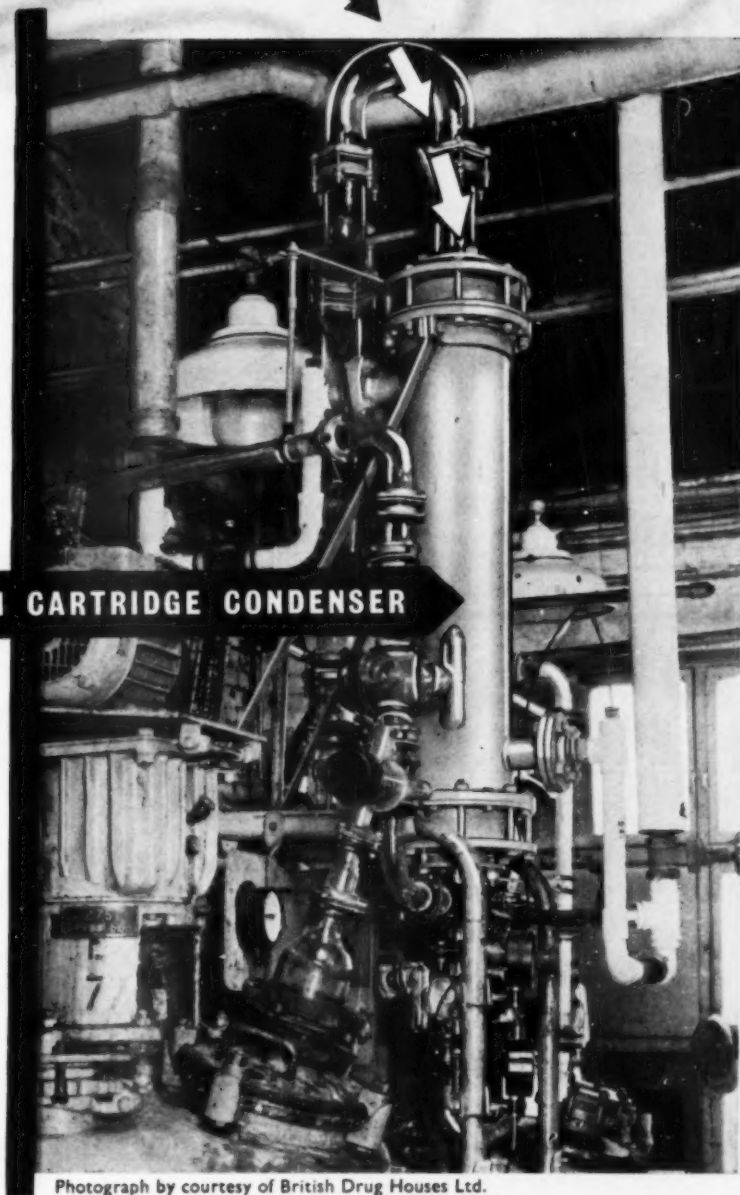
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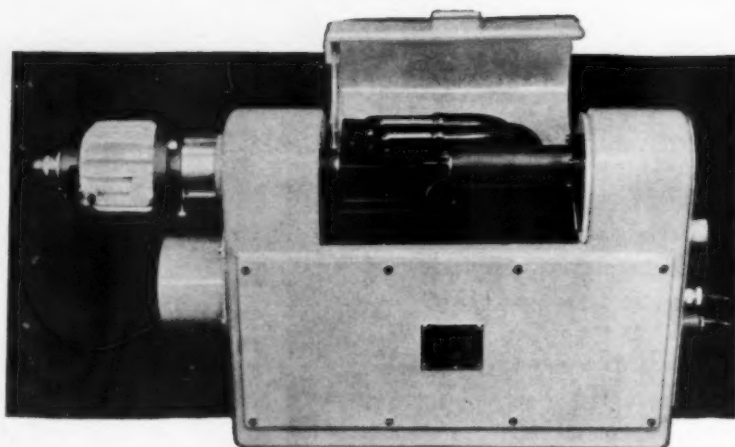
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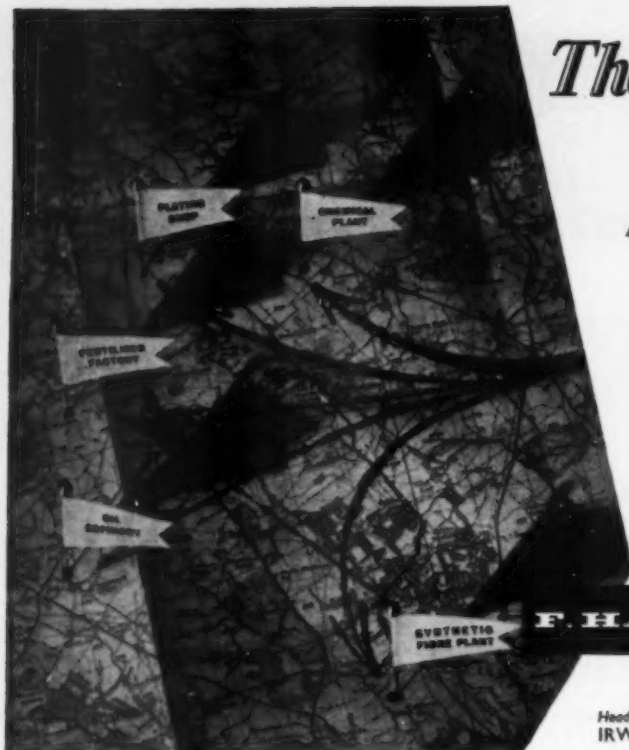
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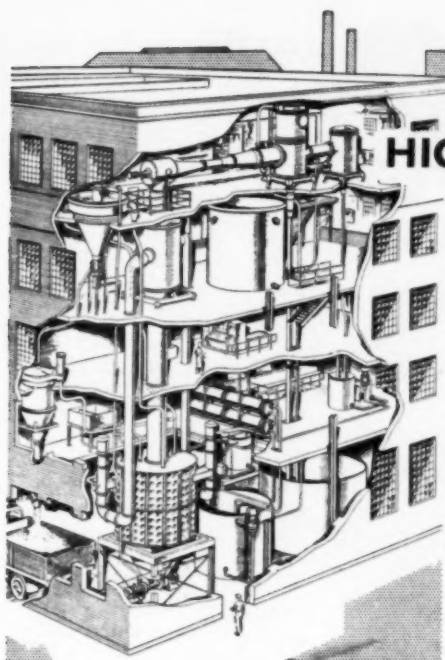
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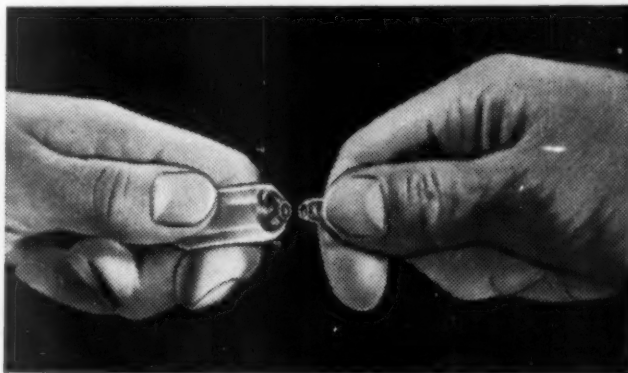
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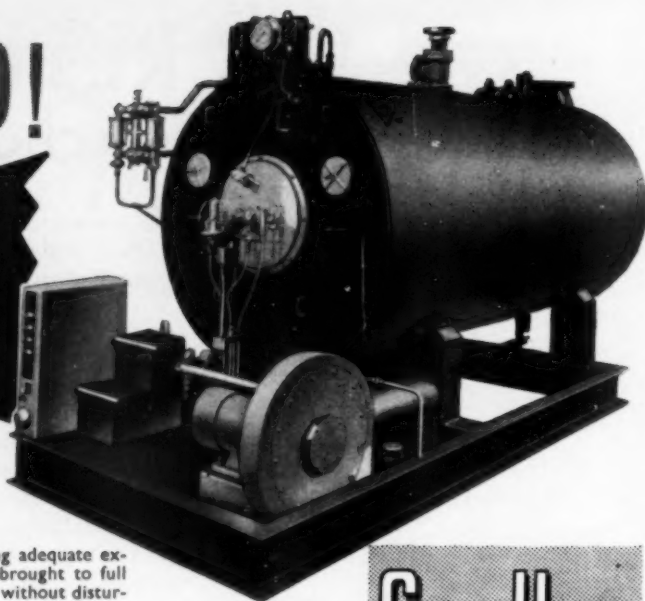
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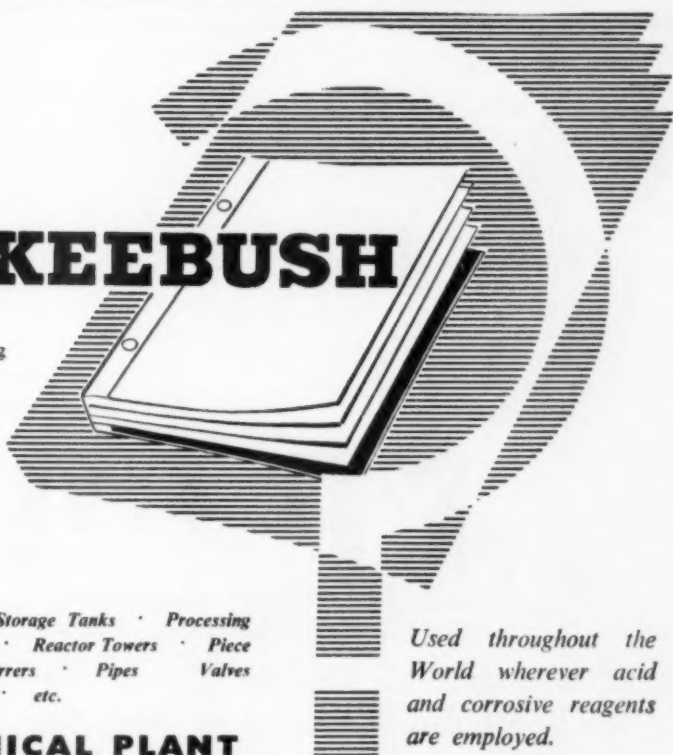
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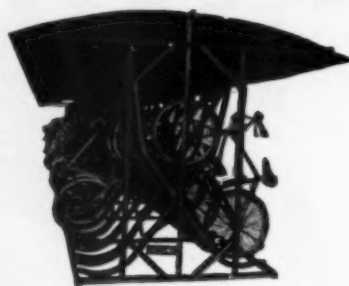
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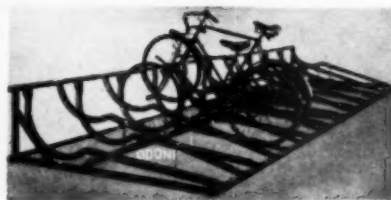
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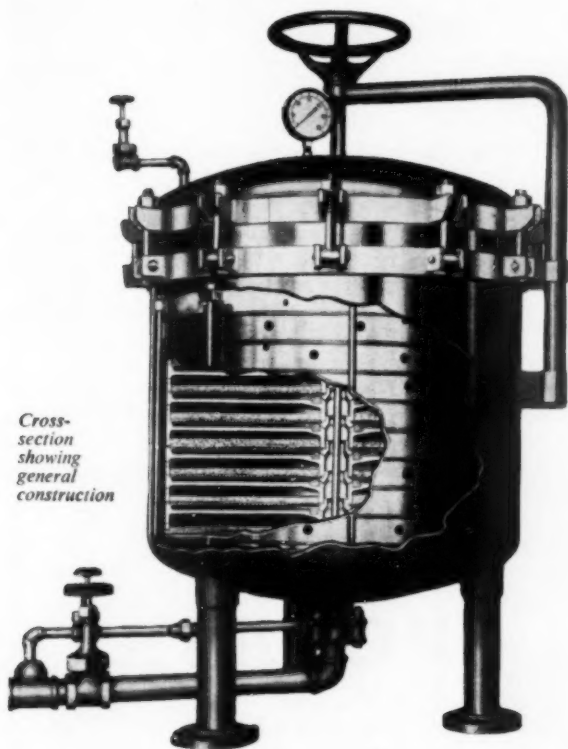
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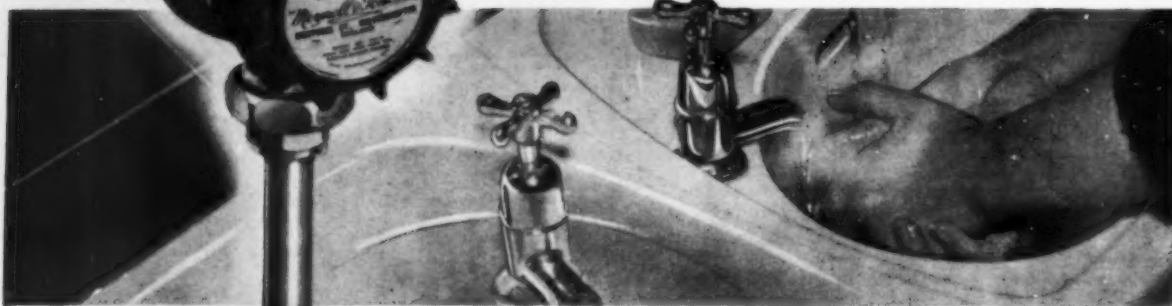
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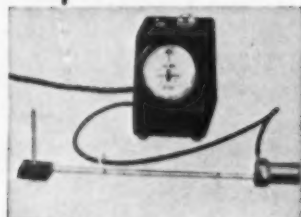
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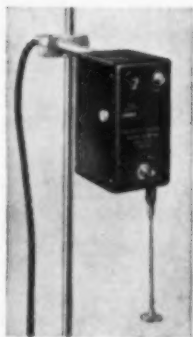
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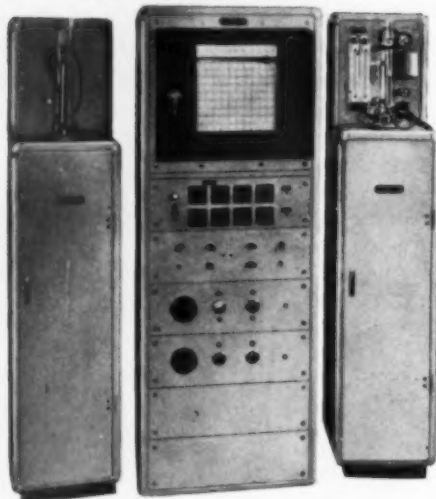
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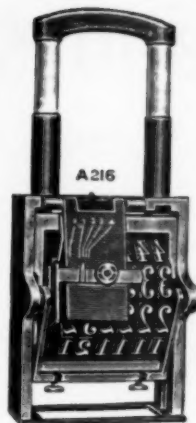
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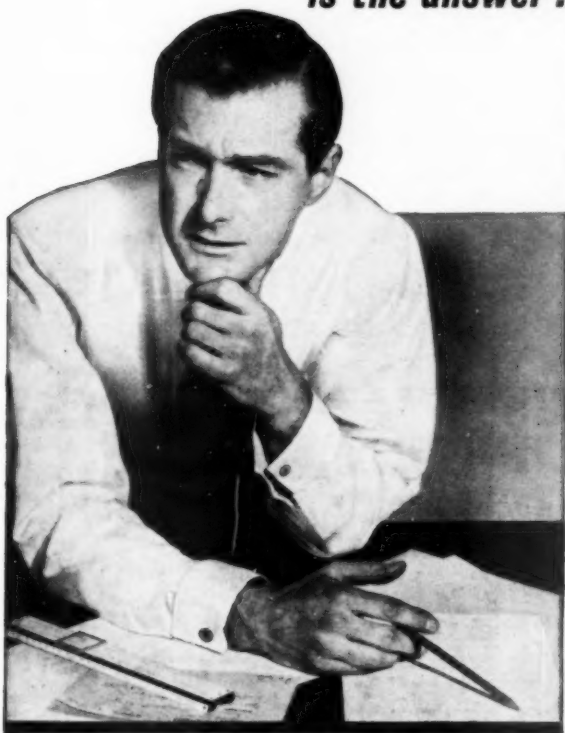
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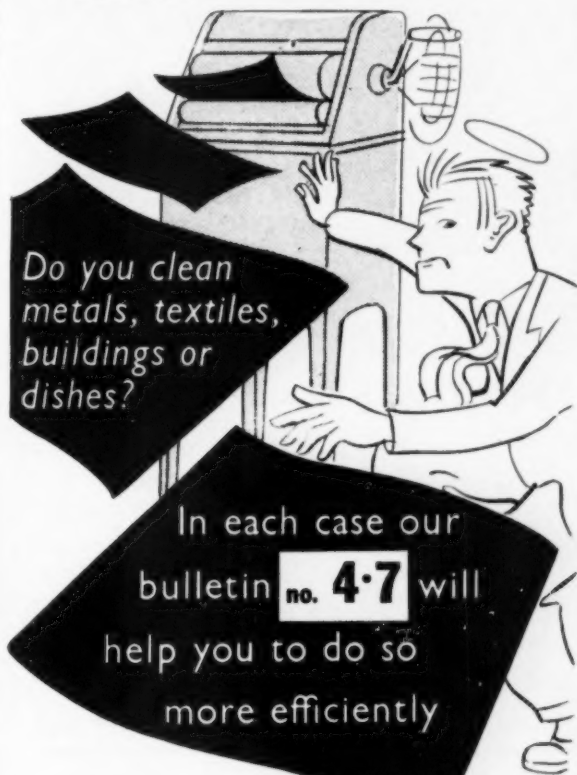
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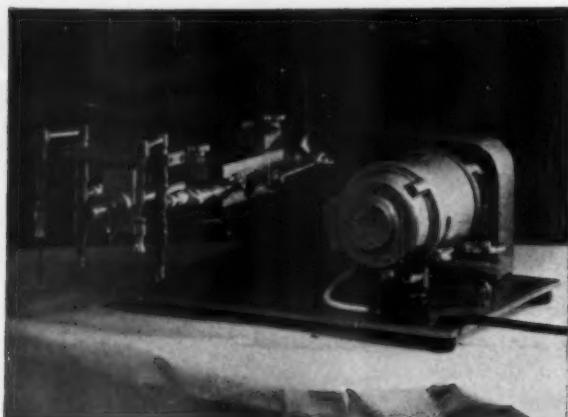
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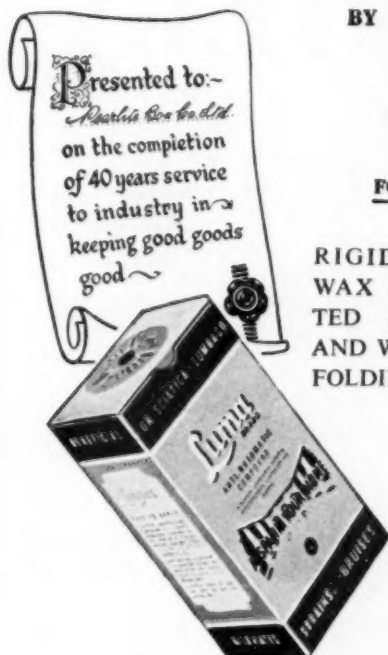
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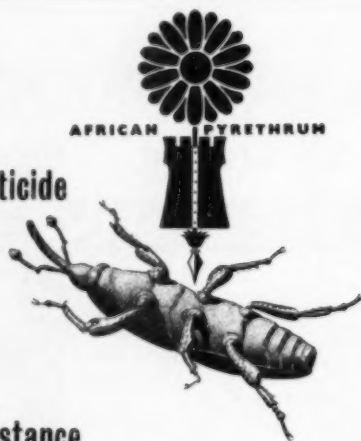
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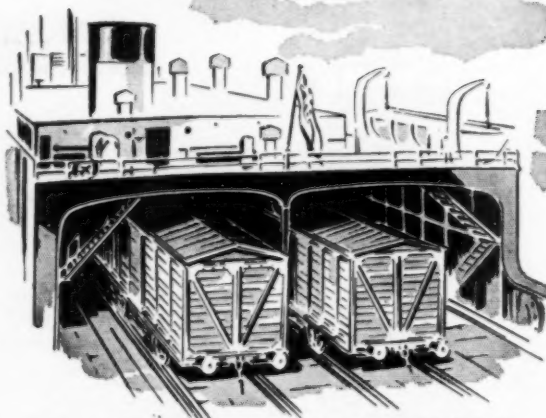
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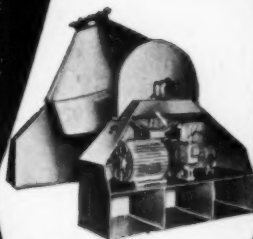
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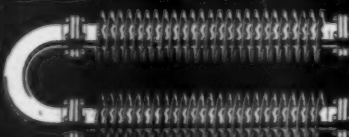
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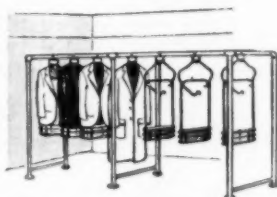
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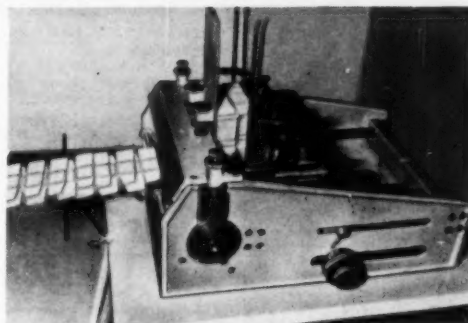


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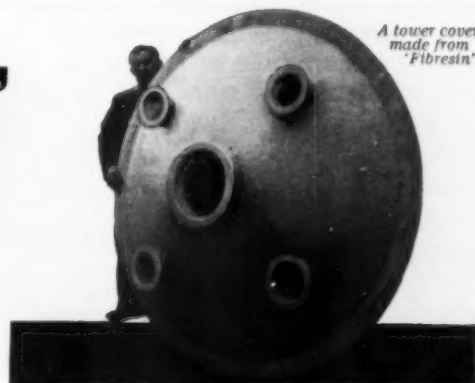
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EUSton 5911.

I.S.I.S. is an organisation backed by a large industrial group of consultants with contacts in all the industries based on technology. As an addition to their present resources they have established this Appointments Register. Below will be found some of those technologists who are looking for further opportunities. Employers and Personnel Officers are invited to complete the form below, detach and send to the above address. In this particular instance the use of a form, with its attendant simplification of office systems, ensures speedier results for the employer.

Ref. A.57. British. Male. Age 58. Married. M.I.Mar.E., First Class B. of T. Cert. for Competency for Steam. Experience: 22 years merchant and Royal Navy. 2 years Admiralty Engineer Overseeing Department as Engineer Inspector. 7 years Staff Foreman marine Engineer installing for new ship construction. 5 years Dredging Engineer. 2 years Superintendent Marine Engineer for new ship construction South America. Seeks post as Maintenance Foreman Boilers, turbines and associated auxiliary machinery, or Hospital Engineer Superintendent. U.K. Salary required £70 per month.

Ref. A.62. Swiss. Male. Age 22. Qualified Switzerland as Laborant (Assistant Chemist). 5 years experience as Assistant Chemist with Swiss Chemical Manufacturers. Resident London during last 6 months perfecting his fluent English. He is now seeking a permanent post either in U.K., France or U.S.A. as a Technical Representative, where his scientific background and fluent German, French and English could be best utilised. Would also be interested in hearing of appointment which included technical translation work and abstraction of technical information. Also interested to hear of appointment in research work, possibly in dyestuff department of chemical manufacturers.

Ref. A.65. British. Male. Married. B.Sc.(Eng.) Diploma Civil Engineering. A.M.I.C.E., M.E.I.C. Experience: 2 years Civil Engineering Assistant airfield construction. 2 years Assistant Road Engineer. 2 years Chief Design Engineer. 2 years Designing Engineer. 3½ years Superintendent of Lights Government of Canada. Approximately 7 years of career has been in Roads and Highways—materials, traffic, resident engineer, design engineer, etc. Responsible 7 million dollars worth of construction work annually on major highways—Canada. Last 3 years has held responsible senior position concerned with aids to navigation and other marine work. Is now seeking a permanent Senior Appointment in Civil Engineering—roads, general construction or administration—in London.

Ref. A.67. British. Male. Age 25. Single. B.Sc. Geology with Chemistry and Physics at Subsidiary Levels. Experience: 2 years with Oil Company as Geologist Middle East. Now seeking appointment in U.K. either as Geological Research Assistant, or would be interested to hear of opportunity as Management Trainee with industrial firm or personnel trainee. Prospects and congenial surroundings more important than salary initially.

Ref. A.66. British. Male. Age 36. Married. A.M.I.E.D. 4 years apprentice with aircraft accessories Company. 5 years Design Draughtsman with same Company. 1 year Design Draughtsman gas control equipment. Design Engineer with Industrial

Consulting Company. 5 years Self-Employed as Industrial Consultant. Experienced in all types of mechanical Design and in control of a mixed drawing office. Security cleared. Now seeks permanent appointment London area as Chief Draughtsman or Assistant Chief Draughtsman. Considers prospects more important than salary suggests commencing salary of £1,200 per annum.

Ref. A.64. British. Male. Age 48. Married. Experience: 3 years Senior Mineral Boring Engineer. 8 years Drilling Manager. 2 years Drilling Supervisor. 8½ years Driller Supervisor Petroleum Company. 3 years Trainee with Petroleum Company. Now seeking permanent position U.K. or abroad as Drilling Manager.

Ref. A.60. British. Male. Age 33. Single. O.N.C. Chemistry. Experience: 6 years Assistant Chemist, Electricity Supply. 5 years Technical Assistant aircraft industry testing and sampling aviation fuels and lubricating oils. Seeks post as Assistant to Manager of Petroleum Storage Installation. London Area or Essex. Salary £800-£900.

Ref. A.55. British. Male. Age 51. Physical Fitness Excellent. A.M.I.Mech.E., M.I.Mar.E., and 2 years advanced course Marine Engineering Design and course on industrial Gas Turbines. Experience: 18 years Royal Navy as Engineer in Charge steam driven machinery. Assistant to Admiralty Engineer Overseers engineering materials and machinery. 3 years Chief Engineer jig and tool manufacturers vibration and sound isolation problems. Production Manager to chemical plant manufacturers. 4½ years Senior Mechanical Engineer Oil Company for development projects, including diesel and gas turbine power stations. 8 years Petroleum Company Station Superintendent with complete charge of Technical and Administrative activities of 300 employees. Now seeking appointment as mechanical Engineer, Maintenance or Design. Salary £1,600 per annum.

Ref. A.61. British. Male. Age 26. B.A.(Chemistry). Married. 1 year Spectroscopic Research. 3 months training course for Production Industrial Engineer. Present Employment: Plant Manager with chemical manufacturers. Speaks fluent French. Requires post Abroad (Canada preferred but would consider other countries) with opportunity to learn and practise modern Production Techniques with commencing salary £1,100 per annum.

Ref. A.68. British. Male. Age 31. B.Sc.(Eng.). Mechanical Engineering 9 years with Aircraft and Guided Weapon Contractor as Assistant Project Engineer. Has undertaken Free Lance Consulting work—Chemical Engineering. Ran own business for 2 years manufacturing water filters. Now seeking appointment in Technical Management, Pure

Research or Technical Sales in U.K., preferably London or West Home Counties, but would consider elsewhere. Would be interested in trainee scheme for technical management of sales. Salary required £1,200 p.a.

Ref. A.71. Irish. Male. Age 23. Just graduated B.E. (Chemical) degree. Dublin. At present studying Economics and Costing Methods in spare time. Now seeking permanent appointment U.K. or abroad as Chemical Engineer—process development or production. Salary £700.

Ref. A.72. Australian. Male. Age 30. Single. Production Engineering Diploma. Grad.I.Prod.E. At present tool and production engineer. Previous experience: 1 year Planning Engineer telecommunications. 1 year Design Draughtsman—domestic appliances. 2 years Methods Engineer Mechanised Rubber Goods. 2½ years Production Plan and Control Trainee—electro-mechanical products. 3 years Precision Engineer Apprenticeship. Has worked U.S.A. and Australia. Now wishes to settle permanently in Britain and requires post as Production Engineer, London area.

Ref. A.73. British. Male. Age 34. Married. O.N.C. Mechanical. Experience: 9 years Capstan Setter Operator. 2 years Draughtsman Electro-Mechanical Engineers. 5 years Draughtsman with Consulting Engineers. Requires appointment London—preferably central or south as Draughtsman with salary of £850.

Ref. A.70. Irish. Male. Recent Graduate, Dublin. Chemical Engineering. Now seeking post U.K. or abroad as Chemical Engineer with salary of £700 p.a.

Ref. A.76. British. Male. Age 56. Married. Graduated Electrical Engineer. Graduated Electronic Engineer. 2 years Lecturer at University—tutorial and laboratory classes. 7 years sound recordist—film factory. 1 year Electronic Engineer audio laboratory. 2½ years Senior Engineer—electronics. 3½ years Senior Designer. Post graduate courses in Pulse Technique. Seeks post as Senior Research Engineer, Middlesex or London, £1,400 p.a.

Ref. A.77. British. Male. Age 25. Married. Second Year National Aero Engineering. Cert. At present employed Electrical Design—aircraft industry. Previous Experience includes 8 months jig and tool draughtsman and 3 years R.A.F. Engine Turbine Fitter. In present post has carried out extensive liaison work and has been Instructor (L.C.C. evening classes) on aero engines. Now seeks post London or Home Counties as Technical Representative. Salary £900 p.a.

[Continued overleaf

To: I.S.I.S. Appointments Register, 9, Eden Street, London, N.W.1. Please ask the following applicants to communicate with the undersigned:

Ref.: _____	Ref.: _____	Ref.: _____	Ref.: _____
Ref.: _____	Ref.: _____	Ref.: _____	Ref.: _____
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Please use Block capitals

Name: _____
 Position: _____
 Company: _____
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 Address: _____

All introductions are made on the understanding that should an engagement result the employer agrees to Appointments Register's terms, which are as follows:

For each person engaged the equivalent of one weeks salary payable by the employer within fourteen days of the date of engagement.

Signature _____ Date _____

I.S.I.S. APPOINTMENTS REGISTER (Continued from overleaf)

Ref. A.78. British. Male. Age 49. Single. Experience: 18 years Designer with Exhibition contractors. 6 years Draughtsman, Ministry of Supply. 6 years Patner Exhibition Contractors. 2 years Draughtsman Tyre and rubber manufacturers. Seeks appointment in Surrey with salary of £1,000-£1,250 p.a.

Ref. A.79. British. Male. Age 40. Married. F.R.I.C., B.Sc.(Spec.) Chemistry and Mathematics. Experience includes 4 years Assistant Plant Manager—Soaps, Detergents, Chemicals and Edible Oils. 2 years Plant Manager Soap, Detergents, Chemicals and Edible Oils. 4 years same field as Technical Director Africa. 2 years same industry Development Manager India. Now seeking senior appointment with excellent prospects requiring technical skill and experience. Salary £3,000 p.a.

Ref. A.80. British. Male. Age 53. 5 years Marine Engineering Apprenticeship. 5 years 6th, 5th, 4th Engineer Tanker Company. 2 years Structural Engineer Oil Company. 2 years Structural and Installation Engineer Colliery. 2 years Structural and Installation Engineer Scottish Company. 4 years Structural and Works Foreman, petroleum company. 5 years War Service in Merchant Navy as Salvage Engineer. 1 year Production Engineer dynamo company. 2 years Field Engineer and 2 years Resident Engineer Oil Company in East Africa. 4 years Design and Development Engineer Sudan. 2 years Field Engineer petroleum company, Pakistan. Inventory of a Cotton "Stalk Pulling Machine". Now seeking a post as Fields or Works Engineer preferably U.K. but would consider abroad. Salary £1,200-£1,500.

Ref. A.81. British. Male. Age 37. Married. Educated to H.N.C. Standard. Associate Member Institute Materials Handling. Experience: including 12 years Chief Draughtsman—Mechanical Handling. 1 year as Executive Engineer with consultants. Is experienced in all forms of materials handling and mechanical handling equipment, both for bulk and package handling, covering complete X range from foundry plants to food handling equipments. Knowledge of Technical Sales. At present Assistant General Manager with Mechanical Handling Company. Now seeking Executive Post in Materials Handling. London area. Salary £1,500.

Ref. A.82. British. Male. Age 30. Married. Final diplomas Institute City & Guilds Chemistry, Bacteriology, Production and Processing Milk and Milk Production. Experience 6 months Factory Manager—dairying. 41 years Factory Manager, large processing dairy. 32 years Dairy Inspector with Dairying Group. Has attended Management School for Senior Executives and Managers, Natal University. Currently studying for C.I.S. Has wide general food technological interest; keen on production, processing, etc. Now seeking a management appointment overseas, except S. or E. Africa, or U.K. (Provinces), with U.K. salary of £1,000 p.a., would also be interested to join management trainee scheme.

Ref. A.83. British. Male. Age 39. Married. Associate Member of Institute of Industrial Technicians. Member of the British Ceramics Society. Member of Institute of Clay Technology. 2 years Management Course. At present employment in Atomic Research (ceramics). Experience: 6 years Ceramics Engineer sparking plug manufacturers. 17 years with crucible manufacturers. Ceramics trainee, foreman. Senior Work Study Engineer. Now seeking appointment on Management Staff in Ceramics Industry, or other processing industry, in Home Counties or South or South West England. Salary £1,500 p.m.

Ref. A.84. British. Male. Age 41. Married. Mechanical Engineer up to N.H.C. 7 years Apprenticeship—aircraft. 2 years Charge Hand—aircraft. 3 years Works Superintendent Heavy Diesel Engine Manufacture. 4 years Section Leader over production development. 2 years Works Manager, machine tools. 21 years Works Manager general engineering. At present General Manager, special purpose machine design. Seeks appointment U.K. or abroad. Salary £1,500 min.

Ref. A.85. British. Male. Age 26. Married. O.N.C., 2nd Class M.O.T. Cert. (Motor). 5 years 10 months General Apprentice Pattern Shop. Foundry and Drawing Office. At present 2nd Engineer Officer in charge of all engine room personnel. Seeks Technical/Supervisory appointment. Anywhere except Middle East. Salary £1,000.

Ref. A.86. British. Male. Age 30. O.N.C. (Mechanical), H.N.C. (Production) Production Control Course, A.M.I.Mech.E., Grad.I.Prod.E. 6 years Apprenticeship Mechanical and General Engineers. 7 months Mechanical Draughtsman Mechanical and General Engineers. 6 months Production Design Draughtsman, electrical mechanical engineers. 6 years Senior Factory Planning Engineer, responsible for planning, work study, rate fixing, methods, etc., with aero and marine engine manufacturers. Seeks post as Assistant Works Manager London or Home Counties or Southern England. Salary £1,300.

Ref. A.87. British. Male. Age 28. Married. Ministry of Transport 1st Class Cert. Marine Engineering (Steam), A.M.I.Mar.E. to be applied for. At present studying for National Certificate in Electrotechnology final year. Experience: 2 years 4th

Engineer. 5 years 3rd Engineer. 5 years Apprentice Fitter—Turner Rayon manufacturer. Seeks appointment U.K. in General Engineering. Salary £850 p.a.

Ref. A.88. British. Male. Age 24. Single. G.C.E. A level Chemistry, Physics, Pure and Applied Mathematics and 1 year full-time Imperial College of Science. Experience: 5 months Bench Assembler—motor component manufacturers. 6 months Mechanic—motor repair work. 1 year Laboratory Assistant Chemical Drying Equipment. 1½ years as Sales Representative. Health excellent. Current driving licence. Seeks post U.K. or abroad as Technical Representative. Salary £750 p.a. or is prepared to study or train with a firm offering a good career through its technical sales department.

Ref. A.89. British. Male. Age 38. Married. S.C. and H.N.C. (Electrical), Associate Member of Institute of Technology. 4 years Tester Electrical Manufacturers. 6 years Engineer in charge laboratory Divisional H.Q. British Electricity Authority. 4 years Development Engineer Meter, Relay and Instrument Manufacturer. 3 years Senior Assistant Engineer Design and Development and Production Electricity Meter and Instrument Manufacturer. Seeks appointment as Design, development or test engineer with manufacturers in London. Salary £1,150-£1,200 p.a.

Ref. A.90. British. Male. Age 43. Married. 6 years apprenticeship aircraft manufacturers. 5 years M/C Shop Foreman—carburettor manufacturers. 1 year Area Inspector Civil Service (Marine). 7 years Works foreman—general engineering. 3 months Works Manager Aircraft Engineers. 6 years M/C shop foreman aircraft and marine engineers. Seeks post as Machine Shop Foreman/Supervisor, Northern England, Lancashire preferred. £850-£1,000 p.a.

Ref. A.91. British. Male. Age 33. Married. O.N.C. (Electrical) level. 5 years Apprentice electrical company. 4 years Draughtsman electrical company. 3 years Draughtsman, 1 year checker and at present service engineer with Furnace manufacturers. Used to handling skilled labour. Completed installations abroad. Seeks post London or Provinces as Assistant Plant Engineer or Assistant Works Engineer, etc. Salary £1,000 p.a.

Ref. A.92. British. Male. Age 22. Married. B.E. (Mechanical) University of N.S.W. Student of Institute of Engineers, Australia (applied for Graduateship). Applied for Grad.I.Mech.E. 9 months Project Design Engineer with structural fabricators. 9 months Design Draughtsman machine tool and special purpose machine manufacturers. At present project engineer with manufacturing company—light metal presswork, timber, plastics. Seeking appointment as Junior Design Engineer or Design Draughtsman in London, Manchester or Leeds with salary £900.

Ref. A.93. British. Male. Age 32. Married. Higher School Cert. Chemistry and Physics. Has reached B.Sc. standard in Chemistry by part-time study. Experience: 2 years Radar Mechanic. 2 years Laboratory Assistant with linoleum and rubber manufacturers. 4½ years Assistant Plant Manager with company manufacturing agricultural chemicals. 2½ years Assistant Works Manager with chemical manufacturers. 2 years as Plant Manager with chemical manufacturers. Seeks appointment London or Provinces as Production/Works Manager. Salary £1,500.

Ref. A.94. British. Male. Age 37. Married. Experience: 5 years apprentice fitter and turner. Admiralty. 4 years Shift charge engineer (power stations). Admiralty. 1½ years Draughtsman Engineering Company. 3 years Design Draughtsman—hydraulic engines. 8 years General Manager—mechanical engineers. At present Assistant Engineer with Consulting Mechanical Engineers. Seeks appointment as Technical Representative or Works Manager. U.K. Salary £800 p.a.

Ref. A.95. German. Male. Age 45. Mechanical Engineer Certificate. Skilled locksmith with experience in engine repair, and electric arc welding. Experience: 7 years as Locksmith. 6 years Engineer. 2 years Engine Service. 3 years Service and Sales experience in automobile fabrication. Seeks appointment U.K. or West or East Africa or Middle East as Mechanical Engineer, willing to begin as locksmith.

Ref. A.96. British. Male. Age 44. A.M.I.Mech.E. Experience: 8 years as apprentice and Junior section leader with engineering Company. 4 years Army as Electrical and Mechanical Engineer. 3 years Design Engineer. 6 years Chief Designer with manufacturing engineers of contractors plant and general mechanical/structural products. Seeks post U.K.—Midlands preferred, as Chief Engineer/Chief Designer. Salary £1,750-£2,000.

Ref. A.97. British. Male. Age 37. Married. A.M.I.Mech.E. 2½ years apprentice and fitter turner. 3½ years Jig and Tool Draughtsman—car body engineers. 1½ years Mechanical Draughtsman with general engineers. 3 years Senior Draughtsman with Mechanical Handling Engineers. 2 years Materials Handling Engineer with general engineers. 2 years Chief Contract Engineer with materials/mechanical handling engineers. Seeks appointment London area

as Technical/Contract/Sales Engineer preferably in materials/mechanical handling. Salary £1,300.

Ref. A.98. British. Male. Age 26. Single. A level G.C.E. Physics, Pure Mathematics, Applied Mathematics and Chemistry. City & Guilds (Intermediate) Instrument Maintenance. Experience: 4 years Technical Commission R.A.F. 2 years Development Assistant with Instrument Company. Seeking appointment in the instrument field (not electronics) where opportunity will be given to develop knowledge of Instrumentation on broader lines and encouragement for continued study. Salary £750 p.a.

Ref. A.99. British. Male. Age 22. Higher National Diploma in Mechanical Engineering. Experience: 6 months Fitter and Turner. 6 months Draughtsman and 6 months assisted site engineers with steel manufacturers. Seeks permanent appointment as Plant or Development Engineer. U.K.—preferably London. Salary £700-£750.

Ref. A.100. British. Male. Age 24. Single. B.Sc. (Chemistry). Prior to H.M. Forces spent 2 months as Technical Sales Assistant with paper and plastics Engineers. Since joining Army has undergone course in Electronics and is now an Instructor in Radar and works on Radar Inspection team. Seeks post in Technical Sales or Liaison in Italy. Salary £700 p.a.

Ref. A.101. British. Male. Age 36. A.M.I.E.E., B.Sc., H.Nat.Cert.Elec. 1½ years apprentice Engineering Company. 2 years Technical Assistant Electrical Rolling Stock—railway. 2½ years Technical Sales. 9 years Electrical and Instrument Engineering with Chemical and Metals manufacturer. Seeks appointment Technical Sales or Works Engineer or electrical or Chief Engineer. London area. Salary £1,750 p.a.

Ref. A.102. British. Male. Age 31. R.E., R.E.A., H.E.C. (Royal Navy) N.A. 1 year Radio Telemetry Engineer. 13 years Radio Electrical Artificer Admiralty. Seeks post in Electron Beam Generating, U.K. or Japan. U.K. salary £1,500.

Ref. A.103. British. Male. Age 24. Married. Grad.I.Prod.E. 5 years General Engineering Student Apprentice. 7 months Estimator Draughtsman steel fabricators. 2 years Trade Test Board H.M. Forces. 7 months Engineer with welding engineers, plastic chemical plant manufacturers. At present Production Manager Sub-Contract Aircraft Engineers. Seeking permanent appointment London or Southern Counties as Training Office—Production Management. Salary £850 p.a.

Ref. A.104. British. Male. Age 34. Married. O.N.C. standard (technical chemistry). 4 years works apprentice—coal (tar by-products). 10 years Oil (petroleum refining) as Process supervisor and Refinery area supervisor. 3 months commissioning refinery manufacturers of process plant. Seeks appointment Supervision of chemical plant anywhere except Middle East or Africa. Salary £1,400.

Ref. A.105. British. Male. Age 39. Married. Experience: 7 years Laboratory Technician with Research Laboratories. 4 years Senior Inspector—radar and general electronics. 1 year Chief Inspector precision engineers. 3 years Chief Inspector. 1 year Senior Mechanical Inspector Electronic Instruments. Seeks post as Chief Mechanical Inspector or Technical Representative, U.K. preferably London area. Salary £900 p.a.

Ref. A.106. British. Male. Married. Age 29. O.N.C. Electrical, C. & G. Institute Electrical "B" Certificate. 2½ years Apprentice Electrical Engineer, electrical assembly and repair. 2½ years Apprentice Electrician—factory maintenance—tin box and steel drum manufacturers. 1½ years Seagoing Chief Electrician. 6 years Seagoing and Staff Electrician. Seeking an appointment in Electrical Engineering, preferably Merseyside, but would consider post anywhere if prospects were sufficient, would be prepared to take training course in new field if necessary. Salary £900 p.a.

Ref. A.107. British. Male. Age 40. Married. B.Eng. Mechanical electrical, B.Sc. applied technology, M.Eng.A.M.I.Mech.E. Experience: 1 year works engineer, textile plant, Ireland. 2½ years Maintenance development engineer Chemical Manufacturers U.S.A. 2 years Lecturers, University and Technical. 1 year Manager, director, chemical manufacturing company India. 1 year Assistant Professor Engineering drawing University U.S.A. 2 years Senior staff engineer Maintenance Chemical Manufacturers U.S.A. Seeking appointment as Manager, Development or Maintenance Engineer in the chemical or other industries, preferably Far East. Salary £2,500.

Ref. A.108. British. Male. Age 34. Single. Professional qualifications equivalent A.M.I.Mech.E. Works experience—all branches of design and development in the light/medium engineering field. For last 7 years various executive engineering, managerial appointments—Production Control, Works and Office Management, Sales and Market Research. Now seeking progressive appointment as General Manager, Works Manager, Technical Director or similar. Salary £2,000 p.a. minimum.

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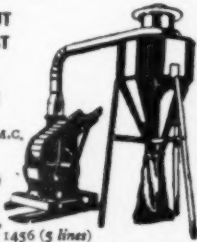
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